2009-1383

(Serial No. 08/998,507)

In The

United States Court of Appeals

For The Federal Circuit

IN RE ALBERT BAUER

APPEAL FROM THE UNITED STATES PATENT AND TRADEMARK OFFICE, BOARD OF PATENT APPEALS AND INTERFERENCES

BRIEF OF APPELLANT

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Dated: October 26, 2009

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UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

In re Albert Bauer v. ____________________

No. 2009-1383

CERTIFICATE OF INTEREST

Counsel for the (petitioner) (appellant) (respondent) (appellee) (amicus) (name of party) Albert Bauer certifies the following (use "None" if applicable; use extra sheets if necessary):

1. The full name of every party or amicus represented by me is:

Alber Bauer

2. The name of the real party in interest (if the party named in the caption is not the real party in interest) represented by me is:

Albert Bauer

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by me are:

None

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court are:

Chapman and Cutler; Robert J. Schneider
Coleman Sudol Sapone P.C.; William J. Sapone

6-22-09
Date

Signature of counsel

William J. Sapone
Printed name of counsel

Please Note: All questions must be answered

cc: ____________________

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THE STATEMENT OF RELATED CASE

No other appeal in or from the same proceeding was previously before this or any other appellate court. No other case is known to counsel to be pending in this or any other court which will directly affect or be directly affected by this court's decision in this appeal.

THE JURISDICTIONAL STATEMENT

Appellant appeals from a decision of the United States Patent and Trademark Office Board of Patent Appeals and Interferences affirming a final rejection of all pending claims of U.S. Patent Application Serial no. 08/998,507, having a Decision Date of March 19, 2009. The Board decision is a final, appealable decision. A Notice of Appeal to this Court was timely filed on May 14, 2009 pursuant to 35 U.S.C. § 142 (2006) and 37 C.F.R. 1.304(a) and (b) (2006). This Court has jurisdiction pursuant to 28 U.S.C. § 1295(a)(4)(A)(2006) and 35 U.S.C. § 1652 (2006).

THE STATEMENT OF THE ISSUES

1. Did the Board incorrectly affirm the final rejection of independent claim 44 by finding the claim term "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature" to be met by a simple thermostatically controlled damper which may allegedly cause "pressure variations (albeit transient)?"

THE STATEMENT OF THE CASE

This is an appeal from a decision by the United States Patent and Trademark Office Board of Patent Appeals and Interferences affirming the final rejection of claims 44-46 and 51-59 of U.S. Patent Application serial no. 08/998,507. (A2-15)

Claims 44 and 51-59 were finally rejected as being anticipated by Johannsen, U.S. Patent no. 4,257,318, ("Johannsen"; A724-738), and as being obvious over Johannsen in view of Rayburn, U.S. Patent no. 5,971,067 ("Rayburn"; A709-738). Claim 45 was rejected as being obvious over Johannsen and Benton, or alternatively over Johannsen, Rayburn and Benton. Claim 46 was rejected as being obvious over Johannsen and Robinson, or, alternatively, over Johannsen, Rayburn and Robinson.[1] (A379-384)

Johannsen is the alleged anticipatory reference, describing a "Variable Dead Band Pressure Control System" which monitors and maintains the pressure in an air conditioning system, actively taking steps to maintain a constant pressure:

> "As the various dampers or outlet controls in the air distribution system are modulated to control airflow, for example under local thermostatic control in the case of an air conditioning system, the air flow demand through the distribution ducts and hence the pressure therein will vary accordingly. The object of a pressure control system is to monitor these pressure variations, and to control the blowers so as to vary their output as required to maintain the desired pressure in the system despite variations in the air load requirements of the building. Too low pressure may interfere with proper ventilation or damper operation, and too high pressure will simply waste energy." (A730; Col. 3, l.3-15)

The Appellant, Albert Bauer, discovered that it is a mistake to follow Johannsen. Providing a control system which "maintain[s] the desired pressure in the system despite variations in the air load requirements of the building" actually

[1] Dependent Claims 45 and 46 stand or fall with Claim 44.

wastes energy, limits fresh air makeup, and causes uncomfortable local hot and cold spots in the air conditioned rooms. (A331)[2]

Instead, by providing regulating means capable of variably increasing or decreasing room pressure in correspondence with room temperature adjustments, i.e. "varying the room pressure in correspondence to a selected room temperature," surprising results occur -- hot or cool spots in a room are eliminated, the amount of fresh air supplied to the room can be increased, up to 100% and most surprising of all, overall energy savings of over 30% can be achieved compared to conventional systems. (A332-3, A104) These benefits are not the product of transient pressure variations, but result from a system which provides dynamic room pressure control directly linked to desired room temperature control. (A335)

No element in Johannsen is capable of controlling room pressure variations as a function of a selected room temperature. Therefore, Claim 44 is neither anticipated by nor obvious over Johannsen.

THE STATEMENT OF THE FACTS

A. Introduction

Albert Bauer invented a unique air conditioning system which differs significantly from conventional air conditioning systems which generally operate with constant volume displacement: that is, air is delivered into a room at

[2] All application references are to the substitute specification, A331-360.

substantially the same volume as the amount that is withdrawn from the room. (A331) The volume of air passing through a room may increase or decrease, but as this equilibrium condition is maintained, room pressure remains constant.

For example, a simple conventional system may operate with a single fan which blows conditioned air into a room as it simultaneously draws air out of the room, the blown in air being heated or cooled as required. Any increase in fan speed to supply more air to the room will inherently draw more air from the room, and so the pressure remains constant.

Moreover, conventional pressure control systems such as the one described in Johannsen are used to assure that the pressure remains constant, regardless of how various individual room or zone temperature control systems react. Johannsen describes a two fan system, but the two fans operate in tandem to assure that the blowers are matched, to keep this equilibrium condition. (A734)

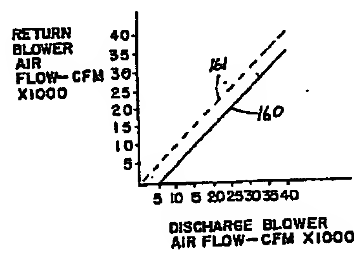


FIG. 5

Mr. Bauer proposed doing the opposite. Instead of using controls to maintain a constant pressure, his air conditioning system requires varying the room pressure, so it may rise or fall in correspondence to the room temperature changes. (A335)

In one embodiment, room pressure is increased from a minimum to a maximum, when an increase in room temperature is required, and correspondingly room pressure is decreased from the maximum to the minimum when a decrease in room temperature is required. (A335)

The room pressure variation is thus determined in response to the selected room temperature, compared relative to the actual room temperature. Once the appropriate increase in room pressure is determined, a control signal issues to the appropriate controlled elements, such as valves, dampers, fans, etc, which are regulated so as to vary the room pressure accordingly.

The specification describes the control system starting with the selected room temperature in order to perform a desired room pressure variation, as illustrated for example in Figs. 6A and 6B (A507-14).

FIG.6a

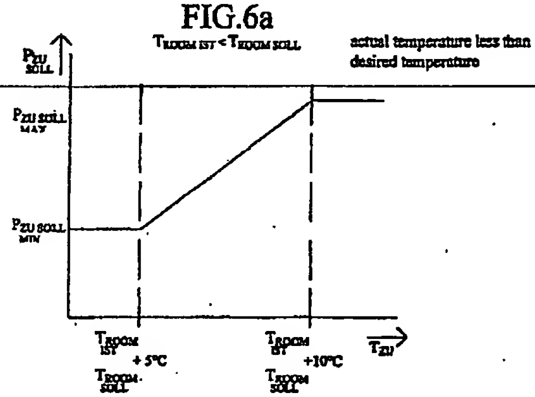
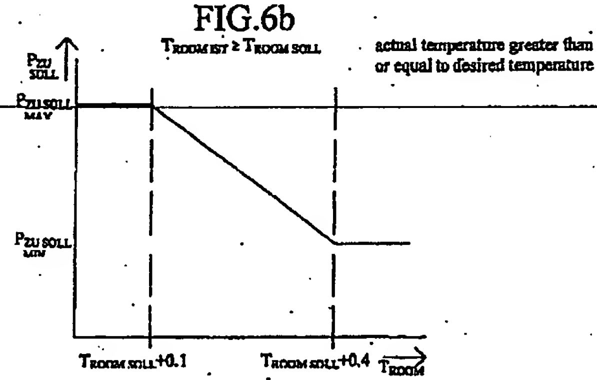


FIG.6b



The results from integrating pressure control with temperature control are surprising and dramatic -- hot or cool spots in a room are eliminated, the amount of

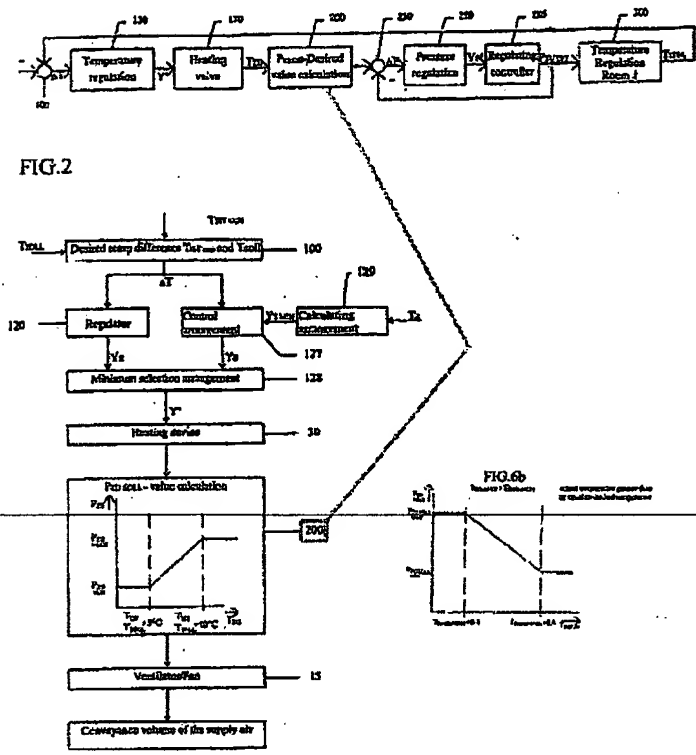
fresh air make-up can be substantially increased up to 100 %, and most surprisingly, energy savings of over 30% are achieved as compared to conventional systems. (A104) These benefits are certainly not the product of "pressure variations (albeit transient)."

B. The Patent Application

Mr. Bauer's U.S. Patent Application no. 08/998,507 was filed on December 26, 1997. It describes an air conditioning system which economically ensures more comfortable room conditions by providing an optimal mixing of room air with supply air to achieve rapid adaption to a desired heating/cooling value. Mr. Bauer discovered that by varying the level of excess room pressure when a change in temperature is desired, the faster the room adapts to the desired temperature, with mixing efficiency improved and large temperature fluctuations avoided. (A332-333).

A complete view of the claimed control system is illustrated in the following figure, which assembles portions of Fig. 2, with Figures 10, and 6b.

The selected room temperature (100) is compared to the actual room temperature. The temperature difference ΔT_n, along with the supply air temperature T_{zu} and the supply air pressure P_{zu} are used by the pressure value calculating controller (200) to generate a desired pressure setting signal which is fed to the pressure regulating circuit (230, 250, 285), and ultimately to the



temperature regulating block element (300). The control valves (60, 61) of Fig. 1 respond not only to effect temperature adjustments, but also to effect pressure adjustments.

The positions of these control values are regulated in dependence on the desired room temperature value, on the actual room temperature, and on the temperature of the supply air, as well as in dependence on the supply air pressure. (A352).

As illustrated in Fig. 6A, when the desired temperature is above the actual temperature, the temperature of the supply air will be increased, and "with further rising air supply temperature, the air supply pressure also is increased, since the regulation of the air supply pressure occurs in dependence on the temperature of the air supply." (A357).

When the desired room temperature is lower than the actual room temperature, the supply air pressure is lowered, as illustrated in the pressure profile of Fig. 6B. (A351).

Claim 44 thus includes means for regulating room pressure, to vary the room pressure in correspondence to a selected room temperature, making room pressure a dynamically controlled variable dependent on the selected room temperature. The advantage is that a large volume of air does not need to be continually circulated and conditioned, as "only that volume is used that is required for a maximally rapid adaptation of the actual room values to the predetermined desired values." (A335).

C. The Interview

An interview was conducted to clarify the invention, attended by among others, Mr. Bauer, Examiner John Ford, and Mr. Heribert Blach, facilities manager for the Johannes Kepler University Linz. (A385) The Examiner viewed and was given a video which showed the results of smoke tests conducted at various locations where the inventive system was used. (A85, 88-90) A Brochure containing a CR-ROM disk was also discussed and a copy of it given to the Examiner, explaining the basis for the significant energy savings. (A92-107)

The smoke tests illustrate how actively linking room pressure control with room temperature control creates uniform mixing of the incoming air to provide an

even distribution, reducing hot and cool spots. Mr. Blach confirmed to the Examiner that the Appellant's system improved comfort, while delivering up to 100% fresh air make-up, with documented energy savings of over 30%.

D. The Claimed Invention

Claim 44 is the only independent claim on appeal and reads as follows:

> 44. An air-conditioning apparatus for controlling a temperature condition in at least one room to achieve a selected room temperature condition for ventilation using temperature adjusted supply air comprising:
>
> a supply air motor for supplying air at a supply air pressure through a supply air channel to the at least one room;
>
> cooling-heating means for adjusting a temperature of the supply air;
>
> means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature. (A415)

E: The Claim Interpretation

This appeal turns on the interpretation of the "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature."

The Appellant believes this limitation requires an assembly of control elements which take as an input, the selected room temperature signal, and which are capable of using that signal to determine a corresponding room pressure

increase, and then of taking steps to vary the room excess pressure in correspondence to (or as a function of) the selected room temperature.

The Board believed no such control was necessary, that this limitation is met solely by the presence of local thermostatically controlled dampers, whose operation may cause transient pressure variations. (A13)

F. The Prior Art

The two references cited against claim 44 are Johannsen and Rayburn, with Johannsen cited as both an anticipatory and obvious reference. However, to the contrary, Johannsen establishes the true novelty and non-obviousness of the invention.

Johannsen is directed to a "Variable dead band pressure control system." The problem to be addressed was stated as follows:

> "As the various dampers or outlet controls in the air distribution system are modulated to control airflow, for example under local thermostatic control in the case of an air conditioning system, the air flow demand through the distribution ducts and hence the pressure therein will vary accordingly. The object of a pressure control system is to monitor these pressure variations, and to control the blowers so as to vary their output as required to maintain the desired pressure in the system despite variations in the air load requirements of the building. Too low pressure may interfere with proper ventilation or damper operation, and too high pressure will simply waste energy." (A729; emphasis added)

Johannsen seeks to maintain a constant pressure regardless of local thermostatic changes, the opposite of the inventive system. Moreover, no

temperature control scheme is presented, as local temperature control is irrelevant to the operation of the Johannsen dead band controller:

> "Damper control boxes 21a and 21b would be thermostatically operated, in the case of an air conditioning system, by separate thermostats in the zones or rooms of the building with which their air discharge is associated, but these temperature control loops are not part of the pressure control system of the present invention, and have therefore been omitted from FIG. 1." (A730; Emphasis added)

Johannsen fails to include each and every element of claim 44 while also ~~teaching away from the claimed invention. This is clear as the operation of the~~ dead band controller would counter-act any attempt to raise or lower the room pressure, as the system must "maintain the desired pressure in the system despite variations in the air load requirements of the building."

Rayburn was only cited as disclosing the missing temperature control system. As admitted by the Board, the proposed combination would operate as Johannsen states, independent of the dead band pressure control system. (A14)

G. The Board Erred in Their Decision

The Board failed to undertake a complete analysis of the disputed term. Having found that controlled elements existed, such as control valves and dampers, the Board believed no more was needed. The Board stated:

> "The throttle valves 60 and the valves control circuit as shown in Fig. 5 ...correspond to the "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature." (A10)

However, Figure 5 only gives the details of element 300 in Figure 2: "The regulating circuit represented in Fig. 2 as a block circuit forming element 300, is reproduced in Fig. 5." (A352). Figure 5 shows only part of the "means for regulating."

Counsel pointed out during oral argument that Figures 2 and 10 best represent the "means for regulating," encompassing more than the components that are ultimately operated. (A9; A697)

A damper or control valve needs an input which instructs it on how to operate. In the claimed invention, the controlled elements must be responsive to vary the room pressure depending on the selected room temperature. This partial portion of Figure 2 integrated with Figure 5 shows an actual room temperature (Tist4) compared to the selected room temperature (100). The difference is passed to the temperature regulation system for adjusting the incoming supply air temperature, but also to a room pressure calculation controller (200) which determines a corresponding room pressure, relative to the selected room

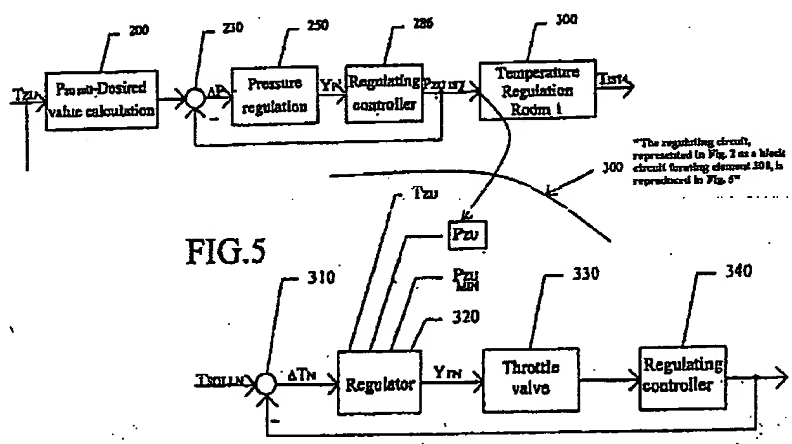
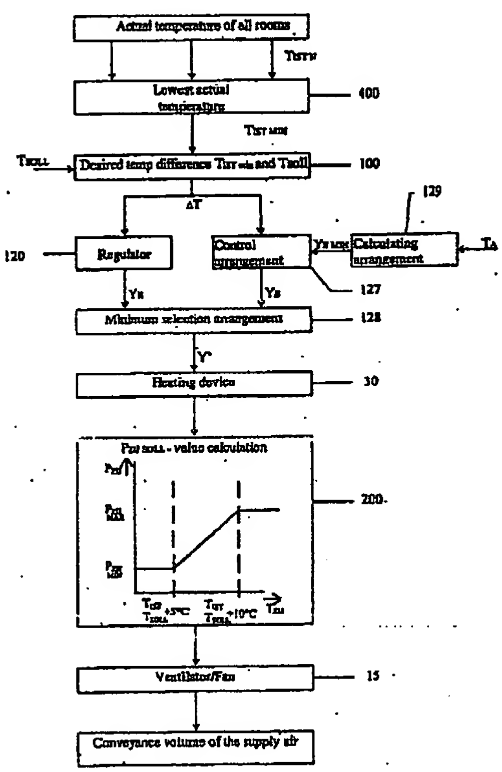


FIG.5

temperature. A signal is then fed to the pressure control elements to vary the increase[3] in room pressure, in correspondence to the selected room temperature.

The Board ignored the fact that the regulator (320) of Figure 5 responds to the determined supply air pressure,.Pzu. Neither cited reference has a temperature regulation circuit that takes as an input, the supply air pressure. There is no integration of temperature and pressure control.

FIG.10



Notice that the same controlled elements, valves, dampers, fans, etc., used as part of the temperature control system are also used for pressure control, but only with the proper integration of control signals.

Bauer Figure 10 illustrates how the difference between the selected temperature and the actual temperature is used to effect a regulated room pressure change while also adjusting the supply air

[3] The term "increase" is used because the system at all times operates with a minimum excess pressure. (A334) The regulating means is thus capable of varying this increase in room pressure.

temperature. It is difficult to understand how the Board equated this control scheme with uncontrolled transient pressure variations.

Neither the Board nor the Examiner found any elements in the prior art capable of performing the control sequence of Figure 10 or even of providing the profiles of Figures 6A and 6B.

THE SUMMARY OF THE ARGUMENT

The Boards' interpretation of the claim phrase "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature," is flawed. The Board misunderstood the invention, and misinterpreted the claim terms, reading the phrase so broadly as to render both the means, that is the "means for regulating" and the function "to vary the room pressure in correspondence to the selected room temperature" meaningless. In the Board's view, any means which produce uncontrolled "pressure variations (albeit transient)" will read on this limitation.

Uncontrolled transient pressure variations, caused for whatever reason, induce a counter-effect from the Johannsen dead band controller, whereas in the Appellant's system, changing the selected room temperature, that is, adjusting a thermostat, will induce a regulating means to determine and then effect a corresponding controlled variation in room pressure.

Claim 44 is neither anticipated nor obviousness. Anticipation requires a reference to describe all the elements of the claims, arranged as in the patented device. Shearing v. Iolab Corp., 975 F.2d 1541, 1544-45, 24 U.S.P.Q.2D (BNA) 1134, 1136 (Fed. Cir. 1992) (See also Dayco Products, Inc. v. Total Containment Inc., 329 F.3d 1358, 1369, 66 U.S.P.Q.2d (BNA) 1801, 1809 (Fed. Cir. 2003), anticipation requires strict identity, without guessing what the reference discloses.)

Johannsen fails to even disclose how temperature control is effected, and specifically admits that "these temperature control loops are not part of the pressure control system of the present invention." (A730) The Board found no element performing a function similar to the controller (200) which determines whether room pressure should be raised or lowered in correspondence to the selected room temperature. Without any control component which accepts the selected room temperature as an input and then determines a corresponding room pressure, one cannot practice the present invention. Every element of claim 44 is not present in Johannsen.

The Johannsen system is essentially "blind" to what temperatures may be called for. There is no temperature sensing; only pressure is monitored. Local damper openings and closings are irrelevant. Pressure changes significant enough to exceed the "dead band" are reacted to, regardless of their cause, to insure that the pressure never varies far from the constant set pressure.

On the other hand, the Appellant requires the room pressure to vary, by way of example, between a minimum and a maximum. The control valve 60 would operate in conjunction with the control valve 61 to effect these increases. This could involve for example, closing the valve 61 while the valve 60 remains fixed, so the valves do not operate in tandem, resulting in more air being delivered than is removed, actively causing an increase in room pressure, "to vary the room pressure in correspondence to [as a function of] the selected room temperature."

Claim 44 is only satisfied by a pressure control system which is responsive to the selected room temperature. Note that <u>the selected room temperature only exists as a control signal</u>. Normally, it is the set point on a thermostat, the thermostat comparing the selected temperature to the actual temperature for generating a control signal. Claim 44 requires the means to regulate the room pressure by reacting to "the selected room temperature." This can only occur if this control signal is communicated to the regulating means.

None of the art cited discloses a pressure regulation system which varies room pressure in correspondence to the selected room temperature.

The Board failed to find any element which meets the claim limitation when properly interpreted, i.e., giving the limitation the broadest <u>reasonable</u> interpretation, <u>consistent with the specification</u>. An interpretation which fails to

consider the claimed temperature/pressure integration is unreasonable and inconsistent with the specification.

No such temperature/pressure integrated control is found in Johannsen or Rayburn. With the disclosure that all pressure variations are to be avoided, Johannsen can not render the claimed invention obvious. In fact, it would be difficult to find a reference which more clearly teaches away from the present invention.

THE ARGUMENT

1. The Statement Of The Standard Of Review

Decisions of the Patent Office Board of Appeals are reviewed in accordance with the standards of the Administrative Procedures Act. Dickensen v. Zurko, 527 U.S. 150, 165, 50 U.S.P.Q.2d 1930, 1937 (1999). Thus, the Board's findings of fact are reviewed to determine if they are supported by substantial evidence, and the legal conclusions for correctness and conformity with the law. In re Gartside, 203 F.3d 1305, 1312-13, 53 U.S.P.Q. (BNA) 1769, 1773-34 (Fed. Cir. 2000). Legal conclusions which are "arbitrary, capricious, an abuse of discretion or otherwise not in accordance with law" will be reversed. Gartside, at 1773.

2. The Legal Standard For Anticipation

Anticipation requires the reference to describe all the elements of the claims, arranged as in the patented device. Shearing, 975 F.2d at 1544-45, 24 U.S.P.Q.2D

(BNA) at 1136; Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 U.S.P.Q.2D (BNA) 1913, 1920 (Fed. Cir 1989); Perkin-Elmer Corp. v. Computervision Corp., 732 F.2d 888, 894, 221 U.S.P.Q. (BNA) 669, 673 (Fed. Cir. 1984); C.R. Bard, Inc. v. M3 Sys., Inc., 157 F.3d 1340, 1349 (Fed. Cir. 1998).

Anticipation requires strict identity, without guessing what the reference discloses. Dayco Products, supra.

3. The Legal Standard For Obviousness

In conducting an obviousness analysis, "[a] fact finder should be aware . . . of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning." KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 421, 127 S. Ct. 1727, 1742, 167 L. Ed. 2d 705, 82 U.S.P.Q.2d (BNA) 1385, 1397 (2007)(hereafter "KSR").

The Court in KSR also stated, "[r]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." Id. at 418 ("To facilitate review, this analysis should be made explicit.") (citing In re Kahn, 441 F.3d 977, 988; 78 U.S.P.Q.2D 1329, 1336 (Fed. Cir. 2006) ... "there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.").

To support a conclusion that a claim would have been obvious, it must be established that all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art. KSR, at 416-417; Sakraida v. AG Pro, Inc., 425 U.S. 273, 282, 189 U.S.P.Q. 449, 453 (1976); Anderson's-Black Rock, Inc. v. Pavement Salvage Co., 396 U.S. 57, 62-63, 163 U.S.P.Q. 673, 675 (1969); Great Atlantic & P. Tea Co. v. Supermarket Equipment Corp., 340 U.S. 147, 152, 87 U.S.P.Q. 303, 306 (1950).

4. Legal Standard Regarding Claim Interpretation

During examination, patent claims are given their broadest reasonable interpretation, consistent with the specification, and more particularly, "upon giving claims their broadest reasonable construction 'in light of the specification as it would be interpreted by one of ordinary skill in the art.'" Phillips v. AWH Corp., 415 F.3d 1303, 1316, 75 U.S.P.Q.2d (BNA) 1321, 1329 (Fed. Cir. 2005)(en banc), quoting In re Am. Acad. of Sci. Tech. Ctr., 367 F.2d 1359, 1364 (Fed. Cir. 2004). It would be unreasonable to adopt an interpretation which is either inconsistent with the patent specification or inconsistent with the interpretation of one skilled in the art.

POINT I

IT IS UNREASONABLE TO INTERPRET THE "MEANS FOR REGULATING" LIMITATION AS READING ON ELEMENTS WHICH PRODUCE UNCONTROLLED TRANSIENT PRESSURE VARIATIONS

A. The Plain Meaning To One Of Ordinarily Skill

Claim 44 includes the phrase "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature." (A415)

It is important to consider first the "plain, ordinary and accustomed" meaning to a person of ordinary skill in the art of air conditioning systems of this language. Rexnord Corp. v. The Laitram Corp., 274 F.3d 1336, 1342, 60 U.S.P.Q.2d (BNA) 1851, 1854 (Fed. Cir. 2001).

The term "means for regulating" means exactly what it says -- one or more elements which can regulate or control a particular parameter.

The term "an increase in room pressure" describes the parameter to be controlled -- the degree of increase in pressure, referred to in the specification as the "excess pressure."

The term "in the at least one room," means what it says -- the actual pressure in at least one room which is being serviced by the air conditioning system, it being understood that the pressure in the supply duct generally determines the

pressure in the room and that an increase in supply air pressure would provide a corresponding increase in the room or zone serviced by the supply air ducting.

The term "relative to an outside pressure" means that the increased room pressure is above ambient.

The term "to vary the room pressure" means that the means for regulating will be capable of actively regulating or controlling the increased room pressure to cause the room pressure to change.

The term "in correspondence to" according to the specification means "in dependence on," or "with reference to," or accepting the Board's determination, "as a function of" a given input. ("Correspondence" is defined by Webster's dictionary as meaning "a: the agreement of things with one another …c: association of members of one set with each member of a second and of members of the second with each member of the first." See also "corresponding … agreeing in some respect (as kind, degree, position, or function)").

The term "the selected room temperature" is the set point for the desired room temperature. When combined with "in correspondence to", the selected room temperature (set point) is used as an input for the means for regulating to use in determining whether the room pressure should be changed and if so, for determining what the room pressure will be.

These interpretations are well supported in the specification.

Regarding the increased room pressure, it is stated:

"If in a large room, several windows are open, the exhaust fan can be shut off entirely – only in this way is it possible to maintain a slight excess pressure." (A355)

"Underlying the invention is the perception that the greater the excess pressure is in a room to be air-conditioned, the better is the ventilation by the supply air blown through the room. Therefore, the room warms up faster, the efficiency of the installation is improved and great temperature fluctuations in the room are avoidable for example, very warm at the top and very cool at the bottom, as are also temperature differences over the length and width of the room." (A332)

The meaning of "in correspondence to" is described as follows:

"The temperature of the supply air and the channel pressure of the supply air are coupled with one another in such a manner that both, in dependence on the value of the room temperature to the value of the supply air temperature and also **in dependence on** the value of the room temperature to the desired value of the room temperature, the channel pressure of the supply air is raised or lowered in the room, rooms, or room zones." (A335, emphasis added)

In one embodiment of the invention, the temperature of the supply air and the channel pressure of the supply air are coupled in dependence on the value of the room temperature and the desired room temperature so that the channel pressure of the supply air is raised or lowered in the room, rooms or room zones. (A335) Heated air with the higher channel pressure is blown into the room only if the temperature of the supply air lies above the predetermined desired temperature of the room. (A335)

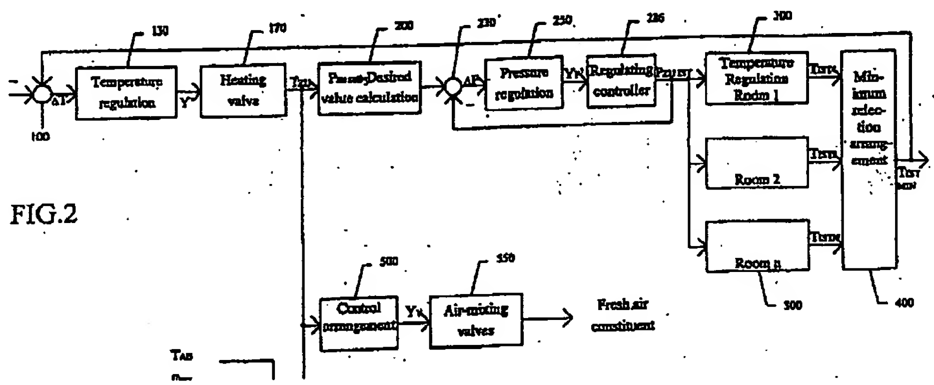
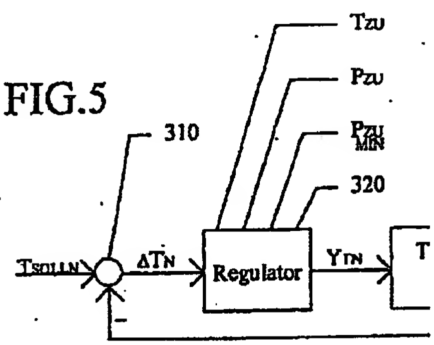


FIG.2

The complete pressure regulation is illustrated above in Figure 2. The selected room temperature is compared to the actual room temperature to generate a regulating temperature. The temperature difference (ΔTn), along with the supply air temperature (T_{zu}) and of the supply air pressure (P_{zu}) are used by the controller (200) to generate a signal which is fed to elements of the temperature regulating circuit (300). The details of block (300) are illustrated in Figure 5, which has a regulator (320) responsive not only to the room temperature but to the adjusted supply pressure(P_{zu}), so the control valves 60 and 61 receive setting signals to either 1) feed more air than is exhausted to increase the room pressure 2) open the same amount to maintain a constant room pressure and maintain a level of

FIG.5



ventilation, or 3) exhaust more air than is supplied so as to decrease the room pressure.

The plain, ordinary and accustomed meaning of the claim terms to one of ordinary skill in the art of air conditioning control systems, supported by the written description, drawings, and the prosecution history, would be that the "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature" means just what it says; an active room pressure control regulation dependent on and responsive to the selected room temperature.

B. <u>Johannsen Does Not Vary The Pressure</u>

The Johannsen system only operates in accordance with point 2 above; the supply and exhaust blowers operate at the same rate; when the supply blower speeds up, the exhaust blower speeds up. The two blowers are required to track together over the entire operating range, as indicated in Figure 5 and described as follows:

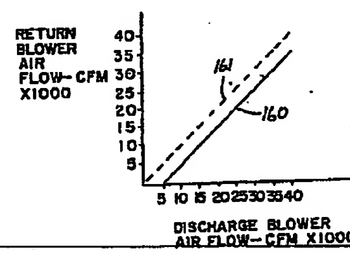


FIG. 5

> "In systems using an additional blower ..., <u>it is necessary</u> to provide proper tracking of the air flow settings of the supply and return fans.... Fig. 5 illustrates <u>the required relationship</u> between air flow of the discharge blower and the return blower in a typical distribution system... curve 160 represents the required relationship between the two blowers for the hypothetical building under discussion. Broken line 161...represents equal values of the supply and return blowers. Curve 160 is offset below curve 161 by a

> constant value of 5000 CFM, so that at a supply blower rate of 40,000 CFM, the return blower requirement is 35,000 CFM and so on down to a 0 return blower requirement for a 5000 CFM supply air flow. (A734)

Without a desired temperature input processed by a controller, the signals that operate the dampers to achieve conditions of points 1 and 3 above can not occur. The system will have no means to vary the increase in room pressure in correspondence to the selected room temperature.

The Board speculated that a damper opening or closing may cause some room pressure variations, "(albeit transient)." One can also speculate that no such pressure variations would occur. The blowers provide significant volumes of air circulating through the supply and exhaust ducts in a multi-room setting, with the air heated or cooled before delivery. With the blowers tracking, any speed increase by the supply blower results in an increase in the exhaust blower, so the air flowing in and out of the room are matched. Any change in room pressure would be insignificant, and if significant, it would be damped by the Johannsen dead band controller.

Without a direct linkage of the pressure and temperature control signals, Johannsen's pressure regulation system cannot vary room pressure in correspondence to the selected room temperature.

For example, the claimed invention is capable of providing the pressure profiles of Figures 6A and 6B, with the pressure regulating means varying the

room pressure as a controlled variable determined in dependence on the desired room temperature so that comfort and efficiency are improved, The system provides an optimal mixing of the room air with the supply air. (A332). Johannsen has no means to provide such profiles.

C. The Board Unreasonably Broadened The Claim Scope

The Board findings were limited to elements which are common to conventional air conditioning system as well as the Appellant's system. Their numbered findings of fact include:

> 1) that Johannsen discloses a supply blower 10 and a return blower 11,
>
> 2) a distribution duct 20, which
>
> 3) branches to a number of outlets in a building. Johannsen also discloses
>
> 5) damper control boxes 21a and 21b, operated by separate thermostats in the rooms where air is discharged.(A5)

Those are all the findings of fact relative to Johannsen, the reference alleged to contain each and every element of the claimed invention.

The Board also found that:

> 6) Rayburn has zone dampers controlled by thermostats,
>
> 7) that the air conditioning systems operate in the conventional way...if the temperature is above or below a set point, either heated or cooled air is requested, and,
>
> 8) the zone temperature controller (thermostat) makes a request for heated or cooled air by opening a damper. (A5-6)

The Board discovered typical components of a conventional air conditioning system. Surprisingly, the Board made no findings as to any means for regulating room pressure, as opposed to room temperature.

The claimed air conditioning system can utilize zone dampers, but in the claimed system, the zone dampers <u>are not controlled only by thermostats</u>; these dampers also receive pressure control signals so that the dampers can be operated to vary the room pressure in dependence on the selected room temperature.

The Board cited for support a discussion at oral argument, but misinterpreted the statements made, ignoring the requirement for temperature and pressure to be dependent, not independent:

> "The Appellant has advanced a broad interpretation of the 'means for regulating an increase in pressure .... ' At one point, the Appellant contended that:
>
>> [t]he regulators, controllers, temperature and pressure sensors, valves, motor controls, etc, are structures that may be used to perform the function specified, in various combinations, <u>arranged for utilizing room temperature as a control signal for effecting pressure variations in a room</u>. Various ways of varying the room pressure are discussed in the specification, such as by varying the supply air motor speed, *opening or closing a throttle valve to supply more or less air to the room,* opening or closing an exit valve, controlling both valves if both are present, or by varying the speed of an exhaust air motor, if one is used.
>
> (Response to Order Under 37 CFR 41.50(d) at 5 (emphasis added))[Underline added by Appellant] The Appellant in the Reply Brief discussed only one asserted corresponding structure, namely, a P_{zu} SOLL [desired supply air pressure] value calculation 200. (See

Reply Br. 11, citing Spec., Figs. 2 and 10). During oral argument, however, the Appellant explained that:

> APJ: What structure is disclosed in the Specification for carrying out that function?
>
> MR. SAPONE: Yeah, I believe that was described in the Reply Brief. There's Figures 2 and 10 that describe the various elements that are involved in the control system **and also** what you're going to be using to do that You have the temperature, heating valve for adding hot air. You have a pressure controller that is also going to control the pressure, and you've got several components here which are in the system which allow you to change pressure when there's a change in temperature.
>
> Now that can be -- getting into specifics, yes, you could have a supply fan that you can ncrease the speed on if you want to increase pressure. *You could have control dampers, which are valves which allow more or less air into the room.* You also have controls on the outside, possibly a damper.

(Record of Oral Hearing 4, II. 4-16 (emphasis added)) In other words, the Appellant has advanced an interpretation of the 'means for regulating an increase in pressure ... ' broad enough to include the throttle valves 60 and the valves' regulating circuits as shown in Fig. 5 as corresponding structures." (A9-10)

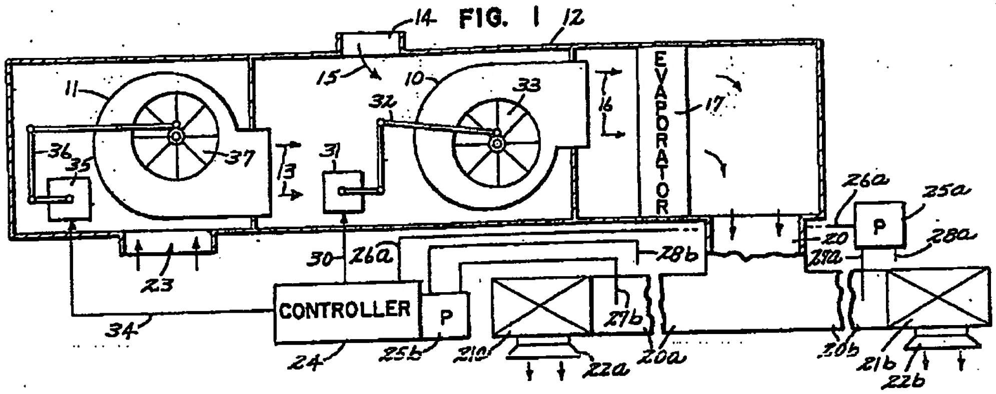
The conclusion that only control valves are needed ignores the fact that Figures 2 and 10 "describe the various elements that are involved in the control system" and that the control valves are the controlled elements. The fans and control valves are operated by the control system of Figures 2 and 10. They must be as the throttle valves 60 and 61 are "dumb"...they do not operate unless directed to do so by a controller.

These valves are only part of the means for regulating, and as stated, "[t]he regulators, controllers, temperature and pressure sensors, valves, motor controls, etc, are structures that may be used to perform the function specified, in various combinations, arranged for utilizing room temperature as a control signal for effecting pressure variations in a room."

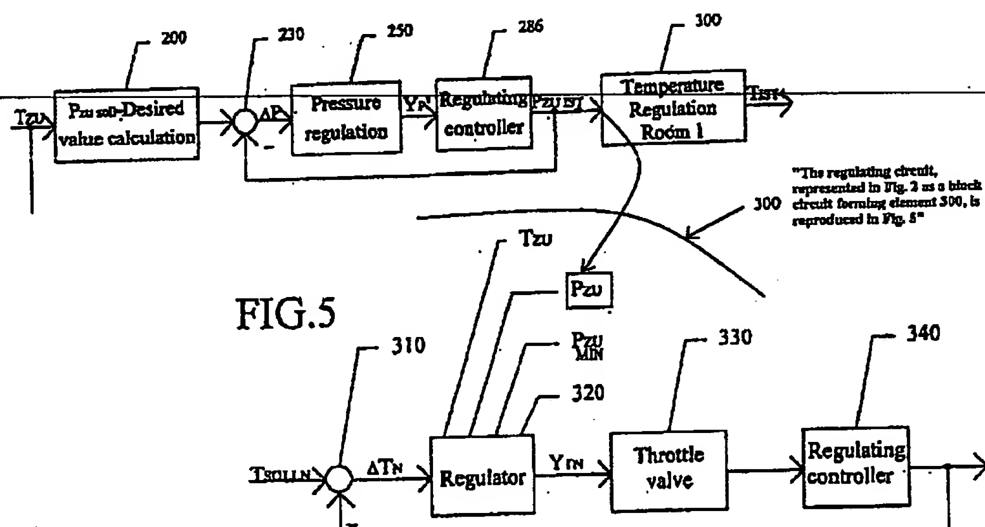
While the various fans, valves and dampers are the ultimately controlled elements, there has to be a regulator or controller to relay the appropriate signal to these devices to effect "varying the room pressure in correspondence to the selected room temperature."

The Board found no such regulator in Johannsen, erroneously believing such a regulator was unnecessary. Instead, the Board alleged that the room damper present in Johannsen was the same and operated the same as the two control valves, 60 and 61, shown in Figure 5. With this simplistic approach, the Board read out the critical part of the claim limitation: having means for regulating the room pressure which directs the specific controlled elements, whether one or more control valves, or a supply fan or an exhaust fan, to operate in a way which will vary the room pressure in dependence on or correspondence to, the selected or desired room temperature.

Looking at Johannsen, the following is shown in Fig. 1:



There is no temperature input to the controller 24; nor is there an output from the controller 24 to the dampers. As indicated in Johannsen, "Damper control boxes 21a and 21b would be thermostatically operated, in the case of an air conditioning system, by separate thermostats in the zones or rooms of the building with which their air discharge is associated, <u>but these temperature control loops are not part of the pressure control system of the present invention, and have therefore been omitted from FIG. 1</u>." (A730, emphasis added)



On the other hand, Appellant's Figure 5 is shown above. Note that the temperature regulator (320) has as an input P_{zu}, the supply air pressure. No such input is incorporated into the damper of Johannsen. Moreover, the complete regulation circuit includes the portions of Figure 2 as shown above.

"The throttle valves 60, 61 are regulated, therefore, in dependence on the desired temperature value $T_{raum\ soll}$ in each room individually, on the actual room temperature $T_{raum\ ist}$ measured in each room individual room, of the value of the supply air temperature T_{zu}, as well as in dependence on the supply air pressure P_{zu} and/or the speed of the supply air motor." (A352, emphasis added)

The damper of Johannsen does not and cannot function "in the same way" as the control valves 60 and 61, as the Johannsen damper cannot respond to signals which call for increased or decreased room pressure.

In the discussion of Figure 5, the Board failed to consider that the temperature control of Figure 5 uses the supply air pressure as a control input, nor give any weight to the fact that the control valves operate in dependence on this signal. Consequently, it was reversible error for the Board to state that:

"Johannsen's thermostatically operated damper control boxes vary the room pressure in correspondence to the selected room temperature in substantially the same way as the throttle valves 60 and the valves control circuitry as disclosed in the Appellant's Specification." (A12-13, emphasis added)

Further, it was reversible error for the Board to so broadly interpret the "means for regulating" such that any "pressure variations (albeit transient)" caused by a conventional thermostatic control system meets the claim limitation.

"Transient" pressure variations by definition are inherently unpredictable and uncontrollable. That a thermostat may send a signal to deliver more or less heat to a room need not result in any pressure change, even a transient one. Certainly, the Board did not even allege that such transient pressure variations are "regulated." To speculate that uncontrolled pressure variations meet the claim limitation ignores that the means for regulating controls the room pressure. The pressure variation itself must be controlled to fall within "the broadest reasonable scope, consistent with the specification" of the claim terms. Transient pressure variations are not controlled and do not fall within the scope of Claim 44.

D. Claim 44 Is Not Anticipated

As stated above, anticipation requires an anticipatory reference to describe all the claimed elements as arranged in the Appellant's system. Shearing, supra.

Johannsen fails to disclose the thermostatic temperature control which operates the dampers shown in Figure 1. Moreover, the description confirms that there is no controller inherently present which would operate these dampers to "vary the room pressure in correspondence to the selected room temperature." Indeed, the selected room temperature signal is nowhere found in Johannsen.

As illustrated above, Figure 5 of the Appellant's invention does utilize the supply air pressure value, as determined by the pressure calculation controller when issuing signals to the control valves 60 and 61, and so has the capability to direct the controlled element to effect one of the three conditions discussed above and shown in Figures 6A, 6B and 10: that is, to effect 1) an increase in room pressure to a maximum P_{zumax}, 2) a decrease in room pressure, to a minimum, P_{zumin}, or 3) to maintain a constant pressure, whether the maximum or minimum, the condition to be determined dependent on at least the selected room temperature.

The control system is illustrated in the following figure, which assembles portions of Figure 2, with Figures 10, and 6b.

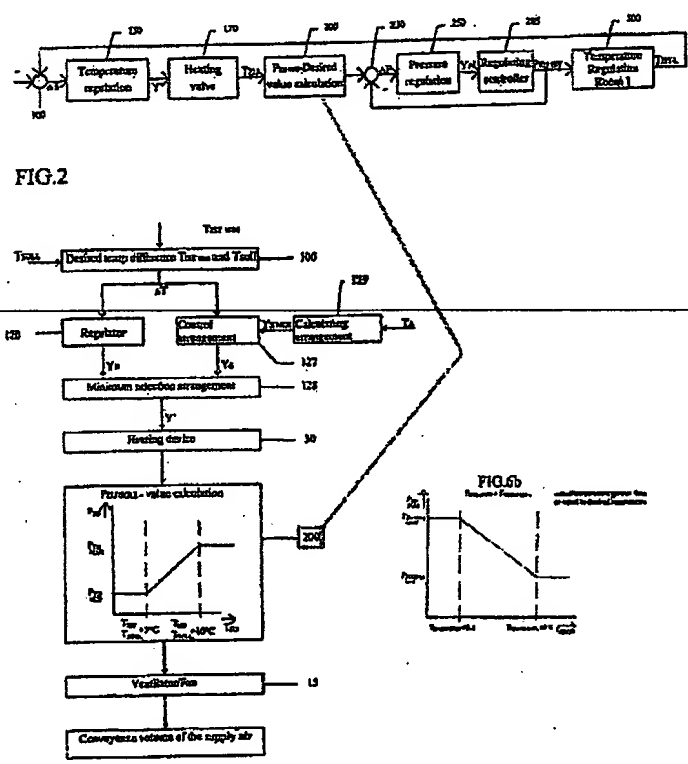


FIG.2

The selected room temperature (100) is compared to the actual room temperature. The temperature difference ΔT_n, along with the supply air temperature T_{zu} and the supply

air pressure P_{zu} are used by the pressure value calculating controller (200) to generate to generate a desired pressure setting signal which is fed to pressure regulating circuit (230, 250, 285), and ultimately to the temperature regulating block element (300). The control valves 60, 61 of Figures 1 respond the same as does the ventilator fan to not only effect temperature adjustments, but also to effect the pressure adjustments to meet the profiles of Figures 6A and 6B.

Such results are impossible to achieve using the Johannsen dead band control system. As stated to the Board:

> JUDGE McCARTHY: Are you saying then that Johannsen does not perform the function that's performed by the means for regulating?
>
> MR. SAPONE: No, it doesn't. It can't because it doesn't have a temperature input. There's nothing in it to say, uh oh, I've got a signal to increase temperature. I've got to change this pressure and make it actually go up or down. It's not there. It's [the Johannsen pressure control system is] an independent system. It's an independently controlled variable. You've got this controller [24] to control pressure, but something else is going to control temperature. If there's some kind of incidental effect with the temperature, with the pressure, this pressure sensor [21] will actually dampen it out. It will take away any increases in pressure whatsoever. So you've [the room pressure has] got to just stay constant the whole time. (A703-04, Emphasis added)

As each and every element of claim 44 is not present in Johannsen, claim 44 and the claims depending therefrom are not anticipated.

E. Claim 44 Is Not Obvious Over Johansen In View Of Rayburn

The Board agreed with the Appellant that "the combined teachings of Johannsen and Rayburn would have suggested no more than the substitution of Rayburn's zone thermistors, thermostatic controllers and zone dampers for Johannsen's thermostatically operated damper control boxes," finding only Rayburn's description to be more complete than Johannsen's description of the thermostatically operated damper control boxes. The Board then summarily and erroneously held "the system of Johannsen as modified by the substitution of Rayburn's damper controls would meet the 'means for regulating an increase in pressure ...' limitation for the same reason the Johannsen system alone did." (A14, emphasis added)

The Board failed to offer any specific findings as to obviousness, and the arguments made above relative to Johannsen are equally applicable to the rejection for obviousness. The quoted statement from oral argument above is equally applicable here. The combination of Johannsen with Rayburn would not provide a system able to perform the function of the Appellant's invention, as the combination fails to provide a selected room temperature input which would result in a controlled room pressure variation.

Claim 44 provides an air conditioning system with means for regulating an increase in room pressure to change the room pressure in dependence on or as a

function of the selected room temperature. Moreover, the invention provides surprising results, significant energy savings over conventional systems, increased delivery of fresh air and increased comfort. The Board found no teaching, suggestion, motivation or prediction that varying the room pressure in correspondence to the selected room temperature could achieve such results.

Johannsen in fact clearly teaches away from the present invention. One skilled in the art is taught to maintain the room pressure regardless of any system requirements.

The Board did not find that Rayburn discloses any means for regulating room pressure in correspondence to the selected room temperature, only disclosing more details on the elements of the thermostatically controlled dampers. (A14) Even granting the combination, one skilled in the art is not led to the Appellant's invention.

The Board did not offer any indication that the combined references would predictably lead one skilled in the art to the present invention, nor could the Board do so. There is no capability to vary room pressure in correspondence to the selected room temperature.

As illustrated in the video viewed by the Examiner and discussed at the interview (A85, 88-90, A385), smoke tests show that when the pressure in a room is controllably varied, air mixing is optimized leading to a uniform temperature

distribution in the room. When the flows into and out of a room are equal, and the pressure remains constant, as described in Johannsen, the newly introduced air fails to mix with the air in the room. Some portions of the room become hotter or colder than others, some more drafty than others. With the inventive system, mixing is optimized so less air circulation is needed, less air needs to be heated or cooled, and the total energy requirements are reduced.

The results using the inventive system are surprising given that Johansson states that the reason the pressure should be maintained constant is because "[t]oo low pressure may interfere with proper ventilation or damper operation, and too high pressure will simply waste energy." (A729)

Following claim 44, room pressure, like room temperature, is a dynamic variable -- some rooms may have a higher pressure, while other rooms a lower pressure, dependent on the particular room temperature requirement.

For example, as described in the specification, when one room connected to the supply duct requires heated air, the supply pressure is increased to increase pressure in the room, to assure rapid warm up. However, at the same time, the control valves 60, 61 associated with other rooms which do not need the additional heated air are both set at a minimum so these rooms only receive adequate pass through ventilation. (A358-359)

Nothing in the prior art teaches, suggests or infers that such a regulated increase or decrease in room pressure would be desirable, nor disclose a pressure/temperature integrated control system which is capable of operating in this way. In fact the opposite is true. Johannsen is the perfect example, providing a system which has no temperature input, and operates to eliminate any pressure variations, the opposite to the present invention.

Simply stated, Johannsen did not recognize or comprehend the important relationship between room pressure and room temperature revealed by Mr. Bauer and embodied in his invention.

The Board's erroneous finding that the thermostatically controlled dampers alone satisfy the claim limitation results in an erroneous holding that Claim 44 is obvious. Consequently, there is no evidence in the cited art to support the Board's conclusion that claim 44 is obvious, and the rejection of Claim 44 should be reversed.

CONCLUSION

All of the evidence supports interpreting the disputed claim term literally to mean what it says -- "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature." Accordingly, this Court should reverse the decision of the Board which utilized an unreasonably broad claim

interpretation, hold that the disputed term requires more than the presence of a thermostatically controlled damper whose operation may induce some transient pressure variations, and that those additional elements are not found in the prior art. For the foregoing reasons, Appellant, Albert Bauer, respectfully requests that this Court to reverse the Board's finding of anticipation and obviousness as to Claim 44.

Dated: October 26, 2009 Coleman Sudol Sapone P.C.

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ADDENDUM

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte ALBERT BAUER

Appeal 2008-6261
Application 08/998,507
Technology Center 3700

Decided: [1]March 19, 2009

Before: WILLIAM F. PATE, III, JOHN C. KERINS, and STEVEN D.A. McCARTHY, *Administrative Patent Judges.*

McCARTHY, *Administrative Patent Judge.*

DECISION ON APPEAL

[1] The two month time period for filing an appeal or commencing a civil action, as recited in 37 CFR § 1.304 (2008), begins to run from the Decided Date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or the Notification Date (electronic delivery).

STATEMENT OF THE CASE

The Appellant appeals under 35 U.S.C. § 134 (2002) from the final rejection of claims 44-46 and 51-59. Oral hearing was held on January 13, 2009. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

We AFFIRM.[2]

Claim 44 is the sole independent claim on appeal. The claim recites an air conditioning apparatus including "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature." The Appellant agrees that this limitation must be interpreted as provided in 35 U.S.C. § 112, ¶ 6 (2002). (Response to Order Under 37 CFR 41.50(d) at 1).

The Examiner rejects:

> claims 44 and 51-59 under 35 U.S.C. § 102(b) (2002) as being anticipated by Johannsen (US 4,257,318, issued Mar. 24, 1981);
>
> claims 44 and 51-59 under 35 U.S.C. § 103(a) as being unpatentable over Johannsen and Rayburn (US 5,971,067, issued Oct. 26, 1999);
>
> claim 45 under § 103(a) as being unpatentable over Johannsen and Benton (US 4,347,712, issued Sep. 7, 1982) or, in the alternative, over Johannsen, Rayburn and Benton; and

---

[2] This application has been the subject of two prior Board actions. On June 9, 2006, a prior panel of the Board in Appeal No. 2006-0278 issued an Order Under 37 CFR § 41.50(d) requiring the Appellant to address issues relating to the interpretation of the "means for regulating an increase in pressure . . ." limitation. On October 31, 2006, the prior panel remanded Appeal No. 2006-0278 to the Examiner ["Remand"].

> claim 46 under § 103(a) as being unpatentable over Johannsen and Robinson (US 4,189,094, issued Feb. 19, 1980) or, in the alternative, over Johannsen, Rayburn and Robinson.

ISSUES

With respect to the rejections of claims 44 and 51-59, the Appellant contends that Johannsen fails to disclose regulating an increase in pressure in at least one room relative to an outside pressure, to vary the room pressure in correspondence to a selected room temperature. (App. Br. 6). The Appellant further contends that the teachings of Johannsen and Rayburn together would not have suggested performing this function. (App. Br. 8-9). The Appellant argues the rejections of claims 45 and 46 under separate headings, merely contending that Benton and Robinson would not have suggested performing this function, either. (*See* App. Br. 9-11).

This appeal turns on two issues:

> Has the Appellant shown that the Examiner erred in finding that Johannsen discloses "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature?"

> Has the Appellant shown that the Examiner erred in concluding that Johannsen and Rayburn would have suggested an air-conditioning apparatus including "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature?"

FINDINGS OF FACT

The record supports the following findings of fact ("FF") by a preponderance of the evidence.

1. Johannsen discloses a multiple blower air distribution system including a supply blower 10 and a return blower 11. (Johannsen, col. 4, ll. 20-23).

2. Johannsen's supply blower 10 supplies air to a distribution duct 20. (Johannsen, col. 4, ll. 31-35).

3. Johannsen's duct 20 branches to a number of outlets throughout the building for distribution of the air. (Johannsen, col. 4, ll. 36-38).

4. Johannsen's duct branches 20a and 20b lead to damper control boxes 21a and 21b. (Johannsen, col. 4, ll. 38-41).

5. Johannsen's damper control boxes 21a and 21b are thermostatically operated by separate thermostats in the zones or rooms with which their air discharge is associated. (Johannsen, col. 4, ll. 41-44).

6. Rayburn discloses a building climate control system including zone dampers controlled by thermostat controllers. (Rayburn, col. 4, ll. 45-47 and col. 7, ll. 1-4).

7. The thermostat controller in each zone of Rayburn's building climate control system includes a heat setpoint and a cool setpoint. The temperature of each zone is measured by a zone thermistor. If a zone thermistor indicates that the temperature in the zone is below the heat setpoint, then the controller for that zone makes a request for heat. If the zone temperature is above the cool setpoint, then the zone controller makes a request for cool air. (Rayburn, col. 7, ll. 4-12).

8. A zone controller makes a request for heat or cool air by opening a zone damper. (Rayburn, col. 7, ll. 21-23).

PRINCIPLES OF LAW

A claim under examination is given its broadest reasonable interpretation consistent with the underlying specification. *In re American Acad. of Science Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004). In the absence of an express definition of a claim term in the specification, the claim term is given its broadest reasonable meaning in its ordinary usage as the term would be understood by one of ordinary skill in the art. *In re ICON Health & Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007); *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997). Limitations not explicit or inherent in the language of a claim cannot be imported from the specification. *E-Pass Techs., Inc. v. 3Com Corp.*, 343 F.3d 1364, 1369 (Fed. Cir. 2003).

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

35 U.S.C. § 112, ¶ 6 (2002). In order to meet a "means-plus-function" limitation, the prior art must (1) perform the identical function recited in the means limitation and (2) perform that function using the structure disclosed in the specification or an equivalent structure. *Cf. Carroll Touch Inc. v. Electro Mechanical Sys. Inc.*, 15 F.3d 1573, 1578 (Fed. Cir. 1994); *Valmont Indus. Inc. v. Reinke Mfg. Co.*, 983 F.2d 1039, 1042 (Fed. Cir. 1993);

Johnson v. IVAC Corp., 885 F.2d 1574, 1580 (Fed. Cir. 1989). Structure described in a specification corresponds to a "means-plus-function" recitation if the specification clearly links or associates the structure to the recited function. *B. Braun Med., Inc. v. Abbott Labs.*, 124 F.3d 1419, 1424 (Fed. Cir. 1997). A structure shown in the prior art may be equivalent to a corresponding structure described in a specification if the structure in the prior art performs the identical function recited in the "means-plus-function" limitation in substantially the same way as the corresponding structure with substantially the same result. *Kemco Sales, Inc. v. Control Papers Co.*, 208 F.3d 1352, 1364 (Fed. Cir. 2000).

"To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently." *In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997). A claim is unpatentable for obviousness under 35 U.S.C. § 103(a) if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." In *Graham v. John Deere Co.*, 383 U.S. 1 (1966), the Supreme Court set out factual inquiries to be considered in determining whether claimed subject matter would have been obvious:

> Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined.

Id., 383 U.S. at 17.

ANALYSIS

The first step in addressing the issues in this appeal is to interpret the "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature" limitation. The Appellant's Specification[3] discloses a multi-room air-conditioning system (Spec. 15, ll. 20-21) including a supply air motor in a supply air channel and an exhaust air motor in an exhaust air channel (*id.* 16, ll. 16-21). The Specification further discloses that:

> With air-conditioning for several rooms, the heated supply air is made available through a common supply air channel. In the case of different desired and actual temperatures of all the rooms, however, each room has a different heating requirement. In order to take this circumstance into account, according to a further form of execution of the invention, in the simultaneous air-conditioning of several rooms or room zones, the individual rooms or room zones are connected in each case through a supply air and an exhaust air line allocated to them from the central supply air and exhaust air channels, and in the individual supply air and/or exhaust air lines, throttle valves are arranged through which the channel pressure of the supply air is adjusted in the rooms or room zones.

(Spec. 8, ll. 5-14).

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[3] All references to the Appellant's Specification are to the substitute Specification filed April 9, 2001.

The Appellant has advanced a broad interpretation of the "means for regulating an increase in pressure . . . ." At one point, the Appellant contended that:

> [t]he regulators, controllers, temperature and pressure sensors, valves, motor controls, etc, are structures that may be used to perform the function specified, in various combinations, arranged for utilizing room temperature as a control signal for effecting pressure variations in a room. Various ways of varying the room pressure are discussed in the specification, such as by varying the supply air motor speed, *opening or closing a throttle valve to supply more or less air to the room*, opening or closing an exit valve, controlling both valves if both are present, or by varying the speed of an exhaust air motor, if one is used.

(Response to Order Under 37 CFR 41.50(d) at 5 (emphasis added)). The Appellant in the Reply Brief discussed only one asserted corresponding structure, namely, a $P_{ZU\ SOLL}$ [desired supply air pressure] value calculation 200. (*See* Reply Br. 11, citing Spec., Figs. 2 and 10). During oral argument, however, the Appellant explained that:

> APJ: What structure is disclosed in the Specification for carrying out that function?
>
> MR. SAPONE: Yeah, I believe that was described in the Reply Brief. There's Figures 2 and 10 that describe the various elements that are involved in the control system and also what you're going to be using to do that. You have the temperature, heating valve for adding hot air. You have a pressure controller that also is going to

> control the pressure, and you've got several components here which are in the system which allow you to change the pressure when there's a change in temperature.
>
> Now that can be -- getting into specifics, yes, you could have a supply fan that you can increase the speed on if you want to increase pressure. *You could have control dampers, which are valves which allow more or less air into the room.* You also have controls on the outside, possibly a damper.

(Record of Oral Hearing 4, ll. 4-16 (emphasis added)). In other words, the Appellant has advanced an interpretation of the "means for regulating an increase in pressure . . ." broad enough to include the throttle valves 60 and the valves' regulating circuits as shown in Fig. 5 as corresponding structures.

The Examiner concludes that the "means for regulating an increase in pressure . . ." corresponds to "the combined action of the supply fan control and the exhaust fan control and the thermostat that opens and closes corresponding throttle control valve 60." (Supp. Ans. 4). More specifically, the Examiner finds that the circuitry regulating the exhaust fan performs the function of regulating an increase in pressure in the at least one room relative to an outside pressure while the circuitry controlling the throttle valve performs the function of varying the room pressure in correspondence to the selected room temperature. (Supp. Ans. 7).

The throttle valves 60 and the valves' control circuits as shown in Fig. 5 of the Specification correspond to the "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature." The

supply air motor, the exhaust motor and their control circuits do not correspond to the "means for regulating an increase in pressure . . ." in a multi-room air-conditioning system. As a prior panel of this Board pointed out (Remand 3), Fig. 2 indicates that the "$P_{ZU\ SOLL}$ value calculation" 200 results in a signal which controls the supply air motor to regulate increases in the actual pressure $P_{ZU\ IST}$ in the supply air channel, not increases in the room pressures. It is through the throttle valves 60 that "the channel pressure of the supply air is adjusted in the rooms or room zones." (Spec. 8, ll. 8-15).

The throttle valves 60 and the valves' control circuits regulate an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature. The Examiner is correct in finding (*see* Supp. Ans. 6) that opening a throttle valve 60 will cause a transient increase in room pressure, however small and short-lived. This increase in room pressure will be regulated by the circuitry which controls the opening of the throttle valve. Since the opening or closing a throttle valve is unlikely to have any immediate effect on the outside air pressure, the room pressure in the at least one room will increase relative to the outside pressure when the throttle valve opens without separate action by the supply air motor or the exhaust motor.

The throttle valves 60 of the multi-room air-conditioning system are regulated to vary the room pressure "in correspondence to" the desired temperature value $T_{RAUM\ SOLL}$ of each room individually by a comparator 310 and the regulator 320. (Spec. 22, l. 25 – 23, l. 1 and Fig. 5). The Appellant points to no definition of the term "in correspondence to" in the

Specification. A previous panel of this Board found that the term "in correspondence to" is sufficiently broad to include "as a function of." (Remand 3). The comparator 310 compares the selected room temperature $T_{SOLL\,N}$ with the actual temperature $T_{IST\,N}$ of the room and supplies a signal representing the difference of the two temperatures to the regulator 320. The regulator 320 generates a control signal on the basis of the difference of the selected room temperature $T_{SOLL\,N}$ and the actual temperature $T_{IST\,N}$ of the room which the regulator 320 feeds to the throttle valve 60. In other words, the comparator 310 and the regulator 320 together generate a control signal for the throttle valve 60 in correspondence to (that is, as a function of) the difference between the selected room temperature $T_{SOLL\,N}$ and the actual temperature $T_{IST\,N}$ of the room.

Although the Examiner interpreted the structure corresponding to the "means for regulating an increase in pressure . . ." more narrowly, including not only the throttle valves 60 and the valves' control circuits but also the supply fan control and the exhaust fan control in the structure, the Examiner's findings nonetheless support a determination that Johannsen discloses "means for regulating an increase in pressure . . . ." Johannsen discloses a multiple blower air distribution system including a distribution duct or supply air channel and duct branches. (FF 1-3). Each duct branch leads to a damper control box. (FF 4). The damper control boxes are thermostatically operated by separate thermostats in the zones or rooms with which their air discharge is associated. (FF 5).

Johannsen's thermostatically operated damper control boxes vary the room pressure in correspondence to the selected room temperature in substantially the same way as the throttle valves 60 and the valves' control

circuitry as disclosed in the Appellant's Specification. A thermostat generates a control signal when the actual temperature is no less than (or no greater than) a setpoint temperature and ceases to generate the control signal when the actual temperature is less than (or greater than) a setpoint temperature. In other words, the thermostat acts as a regulator which compares the setpoint temperature to the actual temperature of the room and generates a control signal which is a function (albeit a step function) of the difference between the setpoint and the actual temperature of the room. A thermostatically operated damper control box opens or closes in response to the control signal generated by the thermostat to regulate an increase in pressure in at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature. Both Johannsen's thermostatically operated damper control boxes and the throttle valves 60 of the Specification produce substantially the same result, namely, pressure variations (albeit transient) in correspondence to the selected room temperature.

Johannsen's thermostatically operated damper control boxes do not vary the room pressure on the basis of supply air temperature and pressure as the throttle valve 60 and the regulator 320 appear to do. While this arguably represents a difference between the way in which the throttle valves 60 and the valves' control circuitry regulate increases in pressure and the way that the thermostatically operated damper regulates pressure increases, the difference is not substantial. The function associated with the "means-plus-function" limitation includes varying the room pressure in correspondence to the selected room temperature but does not include varying the room pressure in correspondence to supply air temperature or pressure. Since

Johannsen's thermostatically operated damper control boxes vary the pressure *in correspondence to the selected room temperature* in substantially the same way that the Appellant's throttle valves and control circuitry do, the damper control boxes are equivalents of the throttle valves and control circuitry for purposes of the "means-plus-function" limitation.

The Appellant is correct (*see* App. Br. 9) that the combined teachings of Johannsen and Rayburn would have suggested no more than the substitution of Rayburn's zone thermistors, thermostat controllers and zone dampers for Johannsen's thermostatically operated damper control boxes. Rayburn's description of the zone thermistors, thermostat controllers and zone dampers is more complete than Johannsen's description of the thermostatically operated damper control boxes. Nevertheless, Rayburn's zone thermistors, thermostat controllers and zone dampers ultimately function as thermostatically operated damper controls. As such, the system of Johannsen as modified by the substitution of Rayburn's damper controls would meet the "means for regulating an increase in pressure . . ." limitation for the same reason the Johannsen system alone did.

CONCLUSIONS

The Appellant has not shown that the Examiner erred in finding that Johannsen discloses "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature." Therefore, the Appellant has not shown that the Examiner erred in rejecting claims 44 and 51-59 under § 102(b) as being anticipated by Johannsen.

The Appellant has not shown that the Examiner erred in concluding that Johannsen and Rayburn would have suggested an air-conditioning apparatus including "means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature." Therefore, the Appellant has not shown that the Examiner erred in rejecting claims 44 and 51-59 under § 103(a) as being unpatentable over Johannsen and Rayburn.

The Appellant's only arguments directed against the rejections of claim 45 and 46 under § 103(a) were that Benton and Robinson failed to remedy perceived deficiencies in the teachings of Johannsen and Rayburn. Since the rejections of claims 44 and 51-59 under § 102(b) as being anticipated by Johannsen and under § 103(a) as being unpatentable over Johannsen and Rayburn are sustained, the Appellant has not shown that the Examiner erred in rejecting claim 45 under § 103(a) as being unpatentable over Johannsen and Benton or, in the alternative, over Johannsen, Rayburn and Benton. Likewise, the Appellant has not shown that the Examiner erred in rejecting claim 46 under § 103(a) as being unpatentable over Johannsen and Robinson or, in the alternative, over Johannsen, Rayburn and Robinson.

DECISION

We AFFIRM the rejections of claims 44-46 and 51-59.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a) (2007). *See* 37 C.F.R. § 1.136(a)(1)(iv) (2007).

<u>AFFIRMED</u>

LV:

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AIR- CONDITIONING APPARATUS

FIELD OF INVENTION

The invention relates to an air-conditioning apparatus which regulates the temperature in at least one room by ventilation with heated or cooled air to a predetermined desired temperature value.

BACKGROUND OF THE INVENTION

Air-conditioning apparatuses are used to create in the air-conditioned rooms comfortable conditions of occupation at any time of year, as they hold the temperature and humidity of the room air within fixed limits' and provide for a sufficient ventilation with fresh air.

In winter the supply air temperature is higher than the room air temperature when the air is also meant to warm the room, and in summer the supply air is injected at a lower temperature in order to hold the room at the desired cooled room air temperature.

Ordinarily, to achieve this, a conventional air-conditioning apparatus circulates too high an amount of air, the temperature of which has been adapted to the heating and cooling requirement. This is regarded as disadvantageous as a large volume of air is circulated even after the desired temperature has already been reached. Moreover, the danger exists that the supply air will be blown into the room through the supply air channel and will immediately leave the room to be air-conditioned through the exhaust air channel. There takes place very little mixing of the new supply air with the air present in the room.

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Further, when air-conditioning several rooms, there is the problem that different desired temperatures are sought in the different rooms. An adaptation of the temperatures which takes into consideration the comfort in each room is possible only with difficulty.

SUMMARY OF THE INVENTION

Underlying the present invention is the problem of providing an air-conditioning apparatus which operates economically, ensures more comfortable room conditions and an optimal mixing of the room air with the supply air, in order to achieve a rapid adaptation to the desired heating, cooling, humidifying and dehumidifying values.

This problem is solved according to the invention by an air-conditioning apparatus which regulates the temperature in at least one room to a predetermined desired temperature value by ventilation with heated or cooled air. The apparatus is provided with a supply air motor which feeds the supply air through a supply air channel to the room to be air-conditioned, with a cooling and/or heating device introduced into the supply air channel for the cooling or warming of the supply air, and with an exhaust air motor which draws the exhaust air through an exhaust channel out of the room to be air-conditioned, in which the desired value for the regulator of the exhaust air motor builds up a room excess pressure established with respect to the outside pressure. Further advantageous embodiments of the invention form the objects of the subclaims.

Underlying the invention is the perception that the greater the excess pressure is in a room to be air-conditioned, the better is the ventilation by the supply air blown through the room. Therefore, the room warms up faster, the efficiency of the

installation is improved and great temperature fluctuations in the room are avoidable for example, very warm at the top and very cool at the bottom, as are also temperature differences over the length and width of the room.

A good flow of air through the room ensures that in the shortest possible time and with a smaller amount of air, a room is heated, cooled, humidified or dehumidified. The smaller amount of supply air blown in is found pleasant. Because of the faster adaptation to the desired heating, cooling, humidifying and dehumidifying values, the efficiency of the air-conditioning apparatus is improved.

In particular, the desired value for the regulator of the exhaust air motor is determined in dependence on the outside temperature and/or on the supply air temperature and/or on the supply air pressure. This regulating of the exhaust air motor, in dependence on the outside temperature and/or on the supply air temperature and/or on the supply air pressure, is important for the optimization of the air flow. The higher the supply air temperature or the supply air pressure is, the greater the excess pressure would have to be for a favorable flow of air through the room to be air-conditioned with the supply air. The lower, however, the outside temperature is, the higher as a rule, therefore, the excess pressure in the room to be air-conditioned has to be. There must, therefore, be present a greater excess pressure for ensuring an optimal flow of air through the room with the blown-in supply air.

On the one hand, preferably the actual value for the regulator of the exhaust air motor is determined by a pressure difference between the channels, which is calculated from the difference between the absolute value of the pressure in the supply air channel and the absolute value of the pressure in the exhaust air channel. It will then be the case that, for example, excess pressure disturbances

will occur in the air-conditioning apparatus in several rooms as a result of opening of windows in individual rooms, and therefore this results in an undesired rise in the excess pressure in the other rooms, taking place through the regulation of the exhaust air motor, by reason of the pressure loss in one room.

On the other-hand, preferably the actual value for the regulator of the exhaust air motor is formed by the room pressure difference which is calculated from the difference between the outside pressure and the room pressure.

Here above all, the room excess pressure varies exclusively over a predetermined temperature range of the outside temperature and/or of the supply air temperature, with a change in the outside temperature or of the supply air temperature, in which with an outside temperature below this temperature range, the room excess pressure has in each case a certain constant value, and, with an outside temperature or supply air temperature above this temperature range, the room excess pressure always has a further definite constant value. Above all, with rising outside temperature, in that temperature range, the room pressure falls from a maximum excess pressure to a minimal excess pressure.

Thereby account is taken of two opposite demands. On the one hand, for a good flow of air through the room to be air-conditioned, it is required that the excess pressure be as high as possible. On the other hand, the excess pressure must not be too great, because it is otherwise felt to be disagreeable, and with too great excess pressure, doors open themselves or no longer can be opened or are closed only with a high expenditure of force.

So that a comfortable regulation will be accomplished and an excess pressure will be ensured independently from the height or the floor level of the room to be air-

conditioned, the room difference pressure is measured at a height or level over 0 (room height). Room height corresponds to outside elevation in respect to sea level.

According to one embodiment of the invention, the temperature of the supply air and the channel pressure of the supply air are coupled with one another in such a manner that both, in dependence on the value of the room temperature to the value of the supply air temperature and also in dependence on the value of the room temperature to the desired value of the room temperature, the channel pressure of the supply air is raised or lowered in the room, rooms or room zones.

The advantages herewith achieved lie especially in that a great volume of air-conditioned air is not unnecessarily circulated, but always only that volume is used that is required for a maximally rapid adaptation of the actual room values to the predetermined desired values.

In this manner not only are savings in energy achieved, but people in the room find it considerably more agreeable when a relatively strong air movement takes place only when the temperature of the blown-in air deviates from the actual temperature. With conventional air-conditioning apparatuses, in contrast, especially during the morning warming-up phase, even at a room temperature that lies far below the desired value, only slightly warmed supply air is blown into the rooms at a high channel pressure. This was hitherto felt to be disagreeable by the persons concerned, but it was regarded as unavoidable.

According to the present embodiment of the invention, heated air with the higher channel pressure is blown into the room only if the temperature of the supply air lies clearly above the predetermined desired temperature of the room and

therewith, in the warming-up phase, lies far above the actual value of the room. By a relation regulation in which the channel pressure of the supply air is set in a fixed relation to the supply air temperature, a corresponding coupling of channel pressure of the supply air pressure to the supply air temperature can be realized especially advantageously.

Preferably the channel pressure of the supply air into the room, the rooms, or the room zones is adjusted over the range of the supply air motor.

For a selecting arrangement, a choice can be made between two delivery volume relations.

In the first place, for the heating case in which the desired value of the room temperature is less than the actual value of the room temperature, the channel pressure of the supply air is lowered with rising room temperature. Correspondingly, for the cooling case in which the desired value of the room temperature is greater than the actual value of the room temperature, the channel pressure of the supply air is lowered with falling room temperature. In the second place, for the heating case in which the desired value or the actual value of the room temperature is less than the supply air temperature and the actual value of the room temperature is less than the desired value of the room temperature, the channel pressure of the supply air is raised with rising supply air temperature. Correspondingly, for the cooling case in which the desired value or actual value of the room temperature is greater than the supply air temperature and the actual value of the room temperature is greater than the desired value of the room temperature, the channel pressure is raised with falling supply air temperature. The increase of the channel pressure of the supply air is found to be pleasant.

Moreover, the efficiency of the heating and cooling apparatus is improved, as will be stated again further below.

According to a further embodiment of the invention, the channel pressure of the supply air varies exclusively over a predetermined temperature range of the supply air temperature. If the supply air temperature presents a value below this temperature range, then the channel pressure of the supply air is allocated in each case to a certain constant magnitude. If the supply air temperature presents a value above the temperature range, then the channel pressure of the supply air is allocated in each case to a further determined constant magnitude.

In particular, with a supply air temperature higher with respect to the room temperature, the channel pressure rises over the predetermined temperature range of the channel pressure from its minimum performance up to its maximum performance with rising supply air temperature, and it correspondingly falls with falling supply air temperature.

Through the two regulating systems of the supply air channel pressure behavior, on the one hand, it is made possible for the efficiency of the air-conditioning apparatus to be improved. With higher channel pressure of the supply air, there is achieved also a more rapid and better flow through the room, and therewith a faster heating up of the rooms. On the other hand, for reasons of comfort, too great an air flow should be avoided, since this is felt to be disagreeable. The opposite demands are now optimally satisfied.

Here, the regulating circuit which regulates the channel pressure of the supply air is subordinated to the temperature regulating circuit; the desired supply channel pressure value being set in a fixed relation to the actual value of the supply air

temperature. Herewith there is avoided any excessive increasing or decreasing in the temperature regulation. The room temperature swings back faster to the desired temperature value.

With air-conditioning for several rooms, the heated supply air is made available through a common supply air channel. In the case of different desired and actual temperatures of all the rooms, however, each room has a different heating requirement. In order to take this circumstance into account, according to a further form of execution of the invention, in the simultaneous air-conditioning of several rooms or room zones, the individual rooms or room zones are connected in each case through a supply air and an exhaust air line allocated to them from the central supply air and exhaust air channels, and in the individual supply air and/or exhaust air lines, throttle valves are arranged through which the channel pressure of the supply air is adjusted in the rooms or room zones.

Thereby undesired air movements are avoided in rooms, the actual and desired values of which are alike or approximately alike. Moreover it is achieved that, for example, in the case of a fully open fresh air control valve, an excessive amount of fresh air is not worked up.

The regulation of the control valves can occur additionally in dependence on supply air pressure or on the speed of the supply air motor.

In such an independent regulation of supply air temperature and individual room temperature, a situation can arise in which a single room has to be heated as rapidly as possible, but other rooms that already lie at their desired temperature are to be heated up as little as possible. When the supply air temperature rises, the individual regulation of these warm rooms will tend to close the control valves.

Therewith, however, these rooms and the persons present in them are cut off from the fresh air supply.

This problem is advantageously solved according to a further embodiment, in which at a supply air temperature that lies above the desired temperature, in rooms the actual temperature of which corresponds to the desired temperature, the requisite minimum volume of fresh air also is blown. In this manner it is achieved that these rooms are supplied with sufficient fresh air; nevertheless, a possible warming of the rooms by reason of a supply air temperature that lies above the desired temperature is avoided insofar as possible. The minimum opening required for the prescribed minimum fresh air volume depends on the supply air temperature and on the fresh air component of the supply air, for the fresh air component of the supply air is reduced, if possible, during the warming-up phase in the morning for a maximally rapid heating up, being replaced by return air.

According to one embodiment, the exhaust air channel and the supply air channel are connected with one another through a return air channel, in which case at least one air exhaust throttle control valve is provided in the return air channel, and at least one fresh air throttle control valve is provided in the fresh air channel engaged ahead of the supply air channel.

According to a further embodiment, the minimum cross section of the throttle control valves is adjusted in dependence on the opening of the fresh air throttle control valve, of the exhaust air throttle control valve and of the mixing air throttle control valve, so that in each regulation situation there is ensured the minimum amount of fresh air.

With regulated channel pressure for the supply air and for the exhaust air, the opening positions of the throttle control valves allocated relative to one another in a room or in a room zone are equal.

Analogously to the heating regulation, there can also take place a cooling regulation.

For the temperature regulation, regulators are used. In practice, these regulators tend to an overswinging and underswinging of the regulating value.

According to a further embodiment of the invention, in each case the setting value of at least one regulator, especially of the temperature regulator, is connected to a subordinated switching arrangement, and the switching arrangement, in the case of an overswinging (exceeding) of the regulating value, selects a value predetermined for it, as the setting value, which clearly lies under the value chosen simultaneously by the regulator.

Such a behavior can advantageously be obtained by an additional control arrangement and a minimum-selection arrangement. This additional control arrangement delivers, in dependence on the regulating difference, a predetermined minimal value for the setting magnitude when an overswinging of the regulating value occurs, and a predetermined maximal value of the setting value when the actual value of the temperature (the regulating value) lies below the desired value. The minimum selection arrangement then in each case selects the minimum, from the values made available by the regulator and the additional control arrangement and forwards the selected value as the setting value. In this manner the additional control arrangements always take over the control of the setting value when by reason of the setting value of the regulator, an

overswinging (exceeding) occurs in the regulating value.

According to a further embodiment of the invention, there are provided a fresh air control valve in a fresh air channel engaged on an inlet side of the supply air channel, a mixed air control valve in a return air channel connecting the supply air channel with the exhaust air channel, and a discharge air control valve in a discharge air channel connecting to the exhaust air channel, in which situation the settings of the fresh air control valve, of the discharge air control valve and of the mixed air control valve are regulated in common dependence on the speed of the supply air motor or on the channel pressure of the supply air, and in which up to a certain minimal opening for ensuring a fresh air minimum, with increasing speed of the supple air motor and /or with rising channel pressure of the supply air, the opening cross sections of the fresh air control valve and of the discharge air control valve can be reduced and the opening cross section of the mixed air control valve can be increased.

The opening position of the fresh air control valve and the opening position of the exhaust air control valve are always of equal size. The opening position of the mixed air control valve is always the difference of the opening position of the fresh air or exhaust air control valve to 100%, for example, if the opening positions of the fresh air control valve and exhaust air throttle control valve are each case 70%, then the opening position of the mixed air control valve is 30%. If the mixed air control valve has an opening position of 70%, then the opening positions of the fresh air and exhaust air control valves are in each case 30%.

In a further preferred embodiment of the invention, more than one room is air-conditioned from a central installation. In the case of different heating requirements for the individual rooms, it is also necessary to make available

through the supply air a sufficient heating capacity for all the rooms. This can be achieved inter alia by the means that the heating required is measured in accordance to the actual temperature of the coldest room, in order to bring also this room to the desired temperature in a short time. Accordingly, in one form of execution of the invention, in the simultaneous air-conditioning of several rooms, the actual temperature of each room is fed to a central regulating arrangement, and a temperature value to be determined individually from these individual actual values, is supplied as an actual value for the heating regulator

According to a further embodiment of the invention, a humidifying arrangement is provided which humidifies the supply air in the supply air channel, in which process the humidifying arrangement is regulated both in dependence on the room moisture or the exhaust air moisture as well in dependence on the supply air temperature..

According to a further embodiment of the invention, there are provided a first heating device installed in the supply air channel, a cooling device located after the first heating device in the supply air channel, and a second heating device installed after the cooling device in the supply air channel for the heating, cooling and dehumidifying of the supply air, the second heating device being regulated for the desired moisture value in dependence on the actual moisture value.

In particular with a rising actual humidity value which already lies above the desired humidity value, the heating performance of the second heating device rises.

The heating performance of the second heating device is regulated either with a regulator or it climbs with rising actual moisture value over a predetermined

moisture range of the room moisture; at a room moisture content below this moisture range, the heating performance has in each case a certain constant magnitude and at a room moisture above the moisture range, the heating performance has in each case a further determined constant magnitude.

It is hereby achieved that a dehumidifying is brought about over a rising room temperature insofar as the actual value of the room temperature remains under the limit value from which the cooling process is initiated. Cooling starts only when the actual value of the room temperature is greater than the desired value of the room temperature plus the temperature displacement dependent on the outside temperature. By the heating-up, and therewith, the dehumidifying of the room over the rising temperature, the room is rapidly dehumidified with a relatively low expenditure of energy.

The channel pressure of the supply air is not raised during the dehumidifying process.

In order to guarantee a minimum amount of fresh air in the room or the rooms, the regulation of the fresh air control valve and of the discharge air control valve occurs in dependence on the opening position of the mixed air control valve.

BRIEF DESCRIPTION OF THE DRAWINGS

The following drawings, which are included to provide further understanding of the present invention and are incorporated in and constitute a part of this specification, illustrate the preferred embodiments of the invention and together with the description serve to explain the principles of the invention.

In the simplest case, a single room is tempered and ventilated with the air-conditioning apparatus. The regulation of a multi-room air-conditioning is described in the example of execution with the aid of the drawings, in which:

Fig. 1 shows a schematic representation of the air circulation in an air-conditioning apparatus according to the invention.

Fig. 2 is a block circuit diagram with the most important elements of the regulating and control arrangements in an example of execution.

Fig. 3 is a block circuit diagram with important elements of the temperature regulating circuit from Fig. 2.

Fig. 4 is a block circuit diagram of a conveyance volume regulating circuit of the supply air from Fig. 2.

Fig. 5 is a block circuit diagram of an individual temperature regulating circuit for each room from Fig. 2.

Fig. 6a shows the relation between the supply air temperature and the supply air pressure for the example of execution when the room actual temperature is less than the desired room temperature value.

Fig. 6b shows the relation between the room temperature and the supply air pressure for the example of execution when the actual room temperature is greater than or equal to the desired room temperature value.

Fig. 7 is a block circuit diagram of the temperature regulator of the example of execution.

Fig. 8a is a block circuit diagram of the regulator of the exhaust air motor of the example of execution.

Fig. 8b is a block circuit diagram with the most important elements from Fig. 8a.

Fig. 8c shows the relation between the desired value of the room difference pressure for the regulator of the exhaust air motor.

Fig. 9 shows the relation between the room exhaust air moisture and the setting value for the after-heater.

Fig. 10 is a run-off diagram with the most important block circuit diagram elements participating in the heating-up process.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In Fig. 1 there is schematically represented the air circulation of a multi-room air-conditioning system. From the rooms 1 to be air-conditioned there lead, on the one hand, supply air lines 5 to a supply air channel 10 and, on the other hand, exhaust air lines 6 to an exhaust air channel 11.

In the supply air line 5 there is arranged in each case a throttle control valve 60 and in the exhaust air line 6 in each case a throttle control valve 61.

The supply air channel 10 and the exhaust air channel 11 are connected. with one another through a return air channel 12.

On inlet side of the supply air channel 10 there is engaged a fresh air channel 20 and on the outlet side of the exhaust air channel 11 there is engaged an exhaust air channel 21.

In the fresh air channel 20 there is provided a fresh air throttle control valve 70, in the return air channel 12 a mixed air throttle control valve 72 and in the exhaust air channel 21 an exhaust air throttle control valve 71.

In the supply air channel 10 there are arranged successively in flow direction of the air a first heating device 30, a cooling device 40, a second heating device 33, a supply air motor 15 and a humidifying device 50.

In the supply air channel there is generated by the supply air motor 15 an air pressure P_{ZU} which provides that the supply air is blown with sufficient conveyance volume into the rooms 1 to be air-conditioned.

Correspondingly in the exhaust air channel 11 there is generated by the exhaust air motor 16 a subpressure P_{AB}, which draws off the room air.

In the simplest case, the pure airing case (office operation), the drawn off room air(i.e. the exhaust air) is taken off through the exhaust air channel 11 and the exhaust air channel 21 to the outer atmosphere, and through the fresh air channel 20, the required supply air is drawn as fresh air into the supply air channel 10. For this, the fresh air throttle control valve 70 and the exhaust air throttle control valve 71 are opened and the mixed air throttle control valve 72 is closed. The fresh air

throttle control valve 70 and the exhaust air throttle control valve 71, always have equal opening settings.

In order to make possible a warming-up of the air-conditioned rooms 1, the drawn-in fresh air flows through the first heating device 30 (preheater) through which drawn-in air is brought according to a heating requirement to the requisite supply air temperature T_{ZU}. After passing the disengaged cooling device 40 and the second heating device 33 (afterheater), it is fed to the humidifying device 50, which supplies the necessary moisture to the air.

Instead of the first heating device 30, in a required cooling of the rooms to be air conditioned, the cooling device 40 is in operation. In the case of excessive humidity, instead of the humidifying device 50, the afterheater 33 is in operation for the dehumidifying. In order to ensure a more rapid heating-up, both the first heating device 30 and also the second heating device 33 can be in operation. This, however is possible for the heating case, not for the dehumidifying case.

The air worked-up in this way is fed to the individual rooms to be air-conditioned, through the supply air motor 15, the supply air channel 10 and the supply air lines 5, with the throttle control valves 60. The volume of the air blown-in and drawn off from each individual room can be regulated by the throttle control valves 60, 61 arranged in the supply air lines 5 and in the exhaust air lines 6 individually.

In the case of increased heat requirement, for example in the morning warm-up phase, it is advantageous to supply the rooms not only with drawn-in fresh air, but to use a part of the drawn-off room air repeatedly, for in the simultaneous warming-up and ventilation the required supply air volume lies far above the fresh air minimum volume. For this reason, in dependence on the supply air

temperature T_{ZU} through a control arrangement (controller) 500 in Fig. 2, a setting value Yv is calculated and supplied to the air throttle control valves 550 in Fig. 2, or 70, 71, 72 in Fig.1.

While the fresh air throttle control valve 70 and the exhaust air throttle control valve 71 receive the same control signal, the mixed air throttle control valve 72 in the return air channel 12, is supplied the exactly opposite control signal. The open position of the mixed air throttle control valve 72 is always the difference between the open position of the fresh air control valve 70 or of the exhaust air control valve 71 and 100%. For example, the open position of the fresh air control valve 70 and of the exhaust air control valve 71 amounts in each case to 70%, then the open position of the mixed air control valve 30 amounts to 30%. If the mixed air control valve has an open position of 70%, then the open position of the fresh air control valve 70 and of the exhaust air control valve 71 is in each case 30%.

In this manner it is possible again to feed a certain proportion of the drawn-off room air through the return air channel 12 to the supply air. Simultaneously through the fresh air channel 20 and the fresh air control valve 70, a corresponding fresh air component is supplied to the supply air. This fresh air component amounts in the example of execution in the airing case (during the office hours) to up to 100%. During office hours, therefore, the mixed air control valve 72 as a rule is not opened, and the fresh air control valve 70 and the exhaust air control valve 71 are normally opened to 100% each. With increased heating requirement and a maximal supply air pressure $P_{ZU\,MAX}$ the fresh air component falls to approximately 10%--warming-up phase in the morning.

In the air-conditioning, from the measured room temperatures $T_{RAUM\ IST1}$, $T_{RAUM\ IST2}$ or $T_{RAUM\ IST\ N}$ in the minimal selection controller 400 in Fig. 2, the lowest value $T_{RAUM\ IST\ MIN}$ is determined and used for the calculation of the heating requirement. For this, the actual temperature $T_{RAUM\ IST\ MIN}$ in the block circuit diagram element 100 is subtracted from the predetermined (maximal) desired temperature $T_{RAUM\ SOLL}$ (of all the rooms). On the basis of the temperature difference T (regulating difference), by the temperature regulation system 130, there is determined a suitable desired value y' for the heating valve 170 of the heating device 30 in Fig. 1.

The setting value Yr calculated in Fig. 3 for the temperature regulation is monitored by the switching controller 125 arranged on an outlet side in order largely to prevent an overswinging of the temperature usual with conventional regulators. In the normal case, as long as $T_{RAUM\ IS\ MIN}$ lies below $T_{RAUM\ SOLL}$, the switching controller 125 forwards the setting value Y_R unaltered as y' onward to the heating valve 170. If, however, $T_{RAUM\ IST\ MIN}$ exceeds the desired temperature $T_{RAUM\ SOLL}$ then, instead of Y_R a much smaller setting value y' will be forwarded on to the heating valve 170. The value of the setting magnitude y' assures in this case the minimally required supply air temperature $T_{ZU\ MIN}$, which is dependent on the outside temperature T_A. In this manner with the example of execution, there is achieved a maximal overswinging of the desired temperature by only 0.3°C; a falling below this virtually does not take place.

The monitoring of the setting signal Y_R of the regulator 120 is executed in the example of execution by a switching controller 127 in Fig. 7 and a minimum selection controller 128. The control arrangement simultaneously generates, for the regulator 120, a setting signal Y_S which takes on a maximally great value as

long as the desired temperature $T_{RAUM\ SOLL}$ lies above the actual temperature $T_{RAUM\ IST}$ and moves down to the very low setting $Y_{S\ MIN}$ as soon as the actual temperature exceeds the desired value.

The setting value $Y_{S\ MIN}$ of the controller 128 is adjusted by the computing system 129 for the cutting-off of the otherwise occurring underswinging of the temperature regulation in dependence on the outside temperature T_A with which the fresh air is drawn in.

The minimum selection controller 128 in each case selects, from the two setting value signals Y_R and Y_S at its disposal, the smaller one and forwards this onward as y' to the heating valve 170. In this manner there is prevented, insofar as possible, an overswinging of the temperature to be regulated.

In dependence on the temperature of the supply air, the conveyance of the supply air motor 15 is adjusted over the generated supply air pressure P_{ZU}. For this first of all, in a $P_{ZU\ SOLL}$ value calculating controller 200 shown in Fig. 2, there is determined a desired value $P_{ZU\ SOLL}$ for the supply air pressure. The relation between the supply air temperature T_{ZU} and the supply air pressure $P_{ZU\ SOLL}$ is given in Fig. 6a, for the case in which the room temperature $T_{RAUM\ IST}$ is less than the desired value of the room temperature $T_{RAUM\ SOLL}$.

Only when the supply air temperature lies clearly above the desired temperature value, in the example of execution by 5°C, is the desired pressure of the supply air increased. When this supply air temperature is below this threshold, only the volume of air necessary for the ventilation of the rooms is blown into the air-conditioned rooms.

The relation between the room temperature $T_{RAUM\ IST}$ and the desired value of the supply air pressure $P_{ZU\ SOLL}$ is represented in Fig. 6b, for the case in which the room temperature $T_{RAUM\ IST}$ is greater than the desired value of the room temperature $T_{RAUM\ SOLL}$, or is equal to the desired value for the supply air temperature $T_{RAUM\ SOLL}$.

With increasing actual room temperature $T_{RAUM\ IST}$, when the room temperature is higher than the desired room temperature value $T_{RAUM\ SOLL}$, the air supply temperature T_{ZU} falls and the supply air pressure P_{ZU} falls from its maximal pressure $P_{ZU\ SOLL\ MAX}$ to its minimal pressure $P_{ZU\ SOLL\ MIN}$.

The desired supply air pressure $P_{ZU\ SOLL}$ determined by the $P_{ZU\ SOLL}$ value calculating controller 200 in Fig. 2 is compared in the block circuit diagram element 230 with supply air actual pressure $P_{ZU\ IST}$. The pressure difference P is supplied to the pressure regulator 250.

The complete pressure regulating circuit is represented in Fig. 4. The regulating difference ΔP is fed to the regulator 240, which sets-in the setting value Y_P. A limit value switch 245 monitors the setting value Y_P, so that a predetermined minimum pressure $P_{ZU\ MIN}$ which corresponds to a predetermined minimum ventilation volume is not gone below. The setting value Y_P of the limit value switch 245 controls the air supply motor 285 in Fig. 4 or 15 in Fig. 1, which generates the pressure of the process regulating controller 286.

With the corresponding regulating circuit by an exhaust air motor 16 in the exhaust air channel 11, a subpressure P_{AB} is generated which, for the maintaining

of a predetermined excess pressure in the rooms, draws off a corresponding volume of air. The regulation of the exhaust air motor 16 will still be further described below.

The tempered supply air in the supply air channel 10 is available through the supply air lines 5 for the ventilating and heating-up of all the rooms 1. With the aid of the throttle valves 60, 61, the volume of the air blown in or drawn off in each room is adapted to the particular actual heating requirement. For this in each case there are used the desired temperature, the actual temperature, the supply air temperature and the minimum ventilation volume for the setting of the throttle valves. This regulating circuit, represented in Fig. 2 as a block circuit forming element 300, is reproduced in Fig. 5.

In the block circuit element 310, the individual desired temperature $T_{SOLL\,N}$ is compared with the corresponding actual temperature $T_{IST\,N}$; the regulating difference T_N ascertained there is supplied to the regulator 320. On the basis of the temperature difference, ΔT_N, of the supply air temperature T_{ZU} and of the supply air pressure P_{ZU}, this generates a setting signal Y_T which must not fall below a minimal value which is yielded from the actual supply air pressure P_{ZU} and from the minimal pressure $P_{ZU\,MIN}$. The setting signal $Y_{T\,N}$ is fed to the throttle control valves 330 in Fig. 5, and 60, 61 in Fig. 1. The regulating controller of this individual temperature regulating circuit is represented by the block circuit element 340.

The throttle valves 60, 61 are regulated, therefore, in dependence on the desired temperature value $T_{RAUM\,SOLL}$ in each room individually, on the actual temperature value $T_{RAUM\,IST}$ measured in each individual room, of the temperature value of the supply air temperature T_{ZU}, as well as in dependence on the supply air pressure

P_{ZU} and/or the speed of the supply air motor.

As stated above, the regulating circuit ensures, for the adjustment of the opening cross section of the throttle valves 60, 61, a certain minimum opening cross section yielded in dependence on the supply air pressure, which cross section is not gone below in the adjustment of the throttle valves 60, 61. This minimum opening cross section is adjusted there in such manner that each room receives a predetermined absolute minimum fresh air volume.

The minimum opening cross section of the throttle valves 60, 61 is likewise adjusted in dependence on the opening of the fresh air valve 70, of the exhaust air valve 71 and of the mixed air valve 72.

With regulated conveyance volume of the supply air and of the exhaust air, the opening settings of the throttle valves 60, 61 allocated to one another in a room 1 are equal.

In the regulating of the exhaust air motor 785 according to Fig. 8b, or 16 according to Fig. 1, the desired value for the exhaust air motor is calculated in dependence on the outside temperature in the $P_{DIFF\,SOLL}$ value calculating controller 710, in which operation this desired value forms a room excess pressure $P_{DIFF\,SOLL}$ established in respect to the outside pressure P_A in dependence on the outside temperature. The desired value $P_{AB\,SOLL}$ can also be determined in dependence on the supply air temperature and/or on the supply air pressure.

The relation between the outside temperature T_A and the desired value for the exhaust air motor gives the desired value for the room excess pressure $P_{DIFF\,SOLL}$,

which is yielded from the difference between the desired value of the exhaust air pressure $P_{AB\ SOLL}$ and the outside pressure P_A, is represented in Fig. 8c. If the outside temperature T_A exceeds a certain limit value, for example an outside temperature of -10°C, the desired value $P_{DIFF\ SOLL}$ of the exhaust air motor falls with rising outside temperature from its maximum $P_{DIFF\ SOLL\ MAX}$ to its minimum $P_{DIFF\ SOLL\ MIN}$ with a further limit value, for example with an outside temperature of +15°C. At an outside temperature before or after this temperature range established by the two limit values, the desired value of the exhaust air motor $P_{DIFF\ SOLL}$ corresponds either to the maximal room difference pressure $D_{DIFF\ SOLL\ MAX}$ or to the minimal room difference pressure $P_{DIFF\ SOLL\ MIN}$.

The desired value of the exhaust air motor $P_{DIFF\ SOLL}$ determined by the value calculating controller 710 in Fig. 8a is compared in the block circuit diagram element 700 with the actual room pressure difference value $P_{DIFF\ IST}$ in one room and in several rooms with the supply air and exhaust air channel pressure differential. The pressure difference ΔP is fed to the pressure regulation system 730.

The complete pressure regulating circuit is presented in Fig. 8b. The regulating difference ΔP_{DIFF} is fed to the regulator 740, which adjusts the setting value $Y_{P\ DIFF}$. If in a large room, several windows are open, the exhaust fan can be shut off entirely--only in this way is it possible to maintain a slight excess pressure. With the setting value $Y_{P\ DIFF}$ of the regulator 740, the exhaust air motor 785 in Fig. 8b, or 16 in Fig. I which generates the pressure is controlled by the regulating controller 786.

The actual value for the regulator 740 of the exhaust air motor 16 or 785 is formed by the actual room difference pressure $P_{DIFF\ IST}$, which is yielded from the

difference between the outside pressure P_A and the room pressure $P_{RAUM\,IST} \doteq P_{AB\,IST}$. The room difference pressure $P_{DIFF\,IST}$ is measured there at a level above 0 (sea level).

The form of execution described can be used analogously for the cooling.

In an additional regulating circuit, the air humidity in the air-conditioned rooms is regulated. It is measured preferably as relative air moisture (in percent of the vapor pressure at full saturation) and expressed by a simplified designation F in the following. It is entirely possible, however, to use instead of the relative humidity, the absolute humidity (g of water vapor per m^3 of air), the vapor pressure, the specific moisture (in g H_2O per kg of moist air) or as mixture ratio (in g H_2O per kg of dry air). With use of the relative humidity, the dependence on the saturation limit is advantageously integrated into the value. According to the VDI ventilation rules, air humidity should amount in winter, at 20°C room temperature, to 35% to 70% relative air humidity, and, in summer, at 22°C air temperature, to 70%, and at 25°C, to 60%.

In the block circuit element 600 in Fig. 1, there is determined the difference between the desired air moisture $F_{AB\,SOLL}$ and actual air moisture $F_{AB\,IST}$, in which representationally for the air moisture in the individual rooms in the example of execution, the moisture of the exhaust air F_{AB} is measured and adjusted. The determined moisture difference ΔF_{AB} is first introduced into a limit value circuit device 610, which on the basis of predetermined minimal and maximal moisture $F_{AB\,MIN}$ and $F_{AB\,MIN}$ in dependence on the supply and exhaust air temperature, prevents the saturation limit from being exceeded in any place in the air circulation. From this limit value switching device 610, a corrected regulating difference $\Delta F_{AB'}$, is now fed to the regulator 620, which controls the air moistener

630 over the control signal Y_L. Thereby, the moisture of the supply air F_{ZU} is adjusted. The regulating controller is represented by the block circuit diagram element 640.

The second heating device 33, in the heating case, may also contain the signal Y' of the first heating device 30. The second heating device (33) serves, however, as an after-heater essentially for the dehumidifying. This second heating device (33) is regulated in dependence on the actual moisture value F_{IST} for the desired moisture value, in which with rising actual moisture value F_{IST} over the desired moisture value F_{SOLL} the heating performance of the second heating device (33) rises. The rise of the heating performance of the second heating device (33) moves over a predetermined moisture range of the room moisture F_{IST}. This relation is represented in Fig. 9. At a room moisture F_{IST} before this moisture range, the second heating device (33) is not in operation.

At a room moisture value F_{IST} above this moisture range, the second heating device (33)--the after-heater--is in operation with its maximal performance.

By a control arrangement (not represented here) it is made certain that the conveyance volume of the supply air is not increased during the dehumidifying process and that only a minimum amount of fresh air is blown in.

For a better illustration of the regulating system, in the following there is described, by way of example, a warming-up process such as ordinarily takes place in the morning. The block circuit diagram elements participating in the run-off of the regulation are represented in Fig. 10. At the time point when the switching-on of the air-conditioning apparatus takes place, the actual temperatures of all the rooms 1 and the temperature of the drawn-in fresh air lie

far above the desired temperature for the rooms 1. Since the temperature of the supply air is still very low, no more supply air is blown into the rooms. For this, a minimal air pressure $P_{ZU\,MIN}$, corresponding to the minimum of fresh air volume, is generated.

At a lower outside temperature below 16° C, the regulator is prior-occupied at the start with a value according to the outside temperature, so that the installation will show no frost disturbance when starting.

From the actual temperatures of all the rooms 1 to be air-conditioned, the minimum-selection controller 400 selects the lowest value and conducts this to the block circuit diagram element 100. Here the regulating difference ΔT between the desired and actual value of the room air temperatures is formed and supplied to the regulator 120 and the controller 127. On the basis of the regulating difference ΔT, the regulator 120 determines a setting value Y_R. Simultaneously with the controller 127, a setting value Ys is determined, which takes on a maximally great value as long as the desired temperature lies above the actual temperature. Of the two setting values Y_S and Y_R, the selection controller 128 selects the smaller one, at this time point the setting value Y_R of the regulator 120, and conducts it onward to the heating device (30). This warms up the air flowing through the air supply channel (10). Therewith, the air supply temperature T_{ZU} rises continuously. From a predetermined temperature threshold value of the air supply, for example $T_{ZU\,SOLL}$ + 5°C, with further rising air supply temperature, the air supply pressure also is increased, since the regulation of the air supply pressure occurs in dependence on the temperature of the air supply. The conveyance volume increases and there takes place a maximally rapid heating-up of all the rooms.

The increased air volume consists not only of fresh air, but a part of the exhaust air again is conducted to the supply air through the environmental air channel 12 in Fig. 1. In this manner, the rooms 1 are sufficiently ventilated and, simultaneously, it is not necessary to heat up much fresh air needlessly.

In the morning heating-up, the fresh air constituent is only—at least—such that the requisite excess pressure is achieved.

When the heating-up process is concluded, usual commercial regulators do not lower the setting value rapidly enough to prevent a rise of the actual temperatures of the rooms I over the desired temperature. For this reason the setting value Y_S of the controller 127 on exceeding of the desired temperature falls to a predetermined minimal value $Y_{S\,MIN}$. Now the minimum selection controller 128 selects the value Y_S of the controller 127 and passes it onward as y' to the heating device 30. Thereupon the air supply temperature again falls, and after a short time the rooms again receive only the minimum fresh air volume that is sufficiently tempered to prevent a lowering of the actual temperature of the air supply below the desired temperature of the air supply. The regulator can therefore slowly reduce its output.

Now there is to be described in addition the case in which only one room has to be heated, while the other rooms have already reached the desired temperature. The selection controller 400 selects the lowest actual temperature of the unheated rooms and passes it on to the block circuit diagram element 100. On the basis of the regulating difference now a setting value y' is set in and the supply air pressure rises correspondingly. So that the rooms will not be supplied with very warm supply air which have already reached the desired temperature, however, the individual room temperature regulation systems 300 regulates the blow-in air

volume of the throttle valves 60, 61 for each room separately. In this manner the throttle valves 60, 61 of the rooms in which the actual temperature are closed to the minimum opening, which ensures that the rooms are sufficiently ventilated. Simultaneously, the throttle valves 60, 61 of the room being heated rising T_{zu} is opened up by the P_{DIFF}, up to 100%, in order to make possible a rapid heating-up. Only when this room has reached its desired temperature does the air-conditioning regulation again set in the minimum ventilation and desired temperature holding state.

It will be apparent to those skilled in the art that various modifications and variations can be made in the air-conditioning apparatus of the present invention without deviating from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this inventions provided they come within the scope of the appended claims and their equivalents.

ABSTRACT

The invention relates to an air-conditioning apparatus which regulates at least the temperature of at least one room to a predetermined temperature desired value ($T_{RAUM\,SOLL}$) by ventilation with heated or cooled supply air. The air-conditioning apparatus has a supply air motor (15) which feeds the supply air through a supply air channel (10) to the room (1) to be air-conditioned, a cooling and/or heating device (30, 40 33) for the cooling or warming of the supply air, and an exhaust air motor (16) which draws the exhaust air from the room (1) to be air-conditioned through an exhaust air channel (11). According to the invention, the desired value ($P_{AB\,SOLL}$) for the regulator of the exhaust air motor (16) forms a room excess pressure established with respect to the outside pressure (P_A).

44. An air-conditioning apparatus for controlling a temperature condition in at least one room to achieve a selected room temperature condition for ventilation using temperature adjusted supply air comprising:

a supply air motor for supplying air at a supply air pressure through a supply air channel to the at least one room;

cooling-heating means for adjusting a temperature of the supply air;

means for regulating an increase in pressure in the at least one room relative to an outside pressure, to vary the room pressure in correspondence to the selected room temperature.

45. The air-conditioning apparatus of claim 44 further comprising a control arrangement for controlling the cooling-heating means to adjust the temperature of the supply air.

46. The air-conditioning apparatus of claim 44 wherein the regulating means further regulates the room pressure relative to an outside air temperature.

51. The air-conditioning apparatus of claim 44 wherein the regulating means regulates the room pressure by adjusting the supply air motor to alter the supply air pressure.

52. The air-conditioning apparatus of claim 44 further comprising a control valve disposed in the supply air channel and wherein the regulating means regulates the room pressure by adjusting the control valve.

53. The air-conditioning apparatus of claim 44 wherein the regulating means regulates room pressure by setting the supply air motor to supply a set increased supply air pressure.

54. The air-conditioning apparatus of claim 44 further comprising an exhaust air motor to withdraw air from the at least one room through an exhaust air channel.

55. The air-conditioning apparatus of claim 54 further comprising means for regulating exhaust air motor to adjust an amount of exhaust air withdrawn from the at least one room.

56. The air-conditioning apparatus of claim 54 wherein the regulating means regulates the room pressure by setting the supply air motor to supply a set increased supply air pressure and by setting the exhaust air motor to withdraw a set amount of exhaust air from the at least one room.

57. The air-conditioning apparatus of claim 54 wherein the regulating means regulates the room pressure by adjusting the exhaust air motor, to adjust an amount of air withdrawn from the room through the exhaust air channel.

58. The air-conditioning apparatus of claim 55 wherein the regulating means adjusts the room pressure by adjusting the exhaust air regulating means to control the amount of exhaust air withdrawn from the room.

59. The air-conditioning apparatus of claim 54 wherein the room pressure is a measured difference between a value of the supply air pressure and a value of an exhaust air pressure.

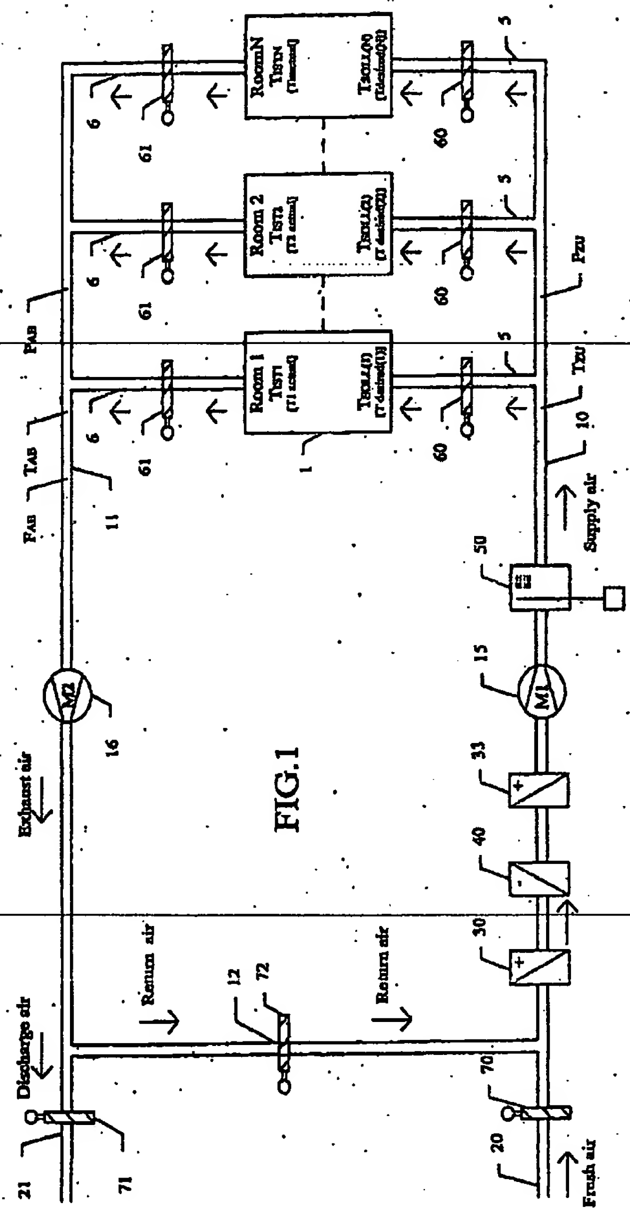

Room 1
Room 2
RoomN
Exhaust air
Discharge air
Return air
Return air
Supply air
Fresh air

FIG.1

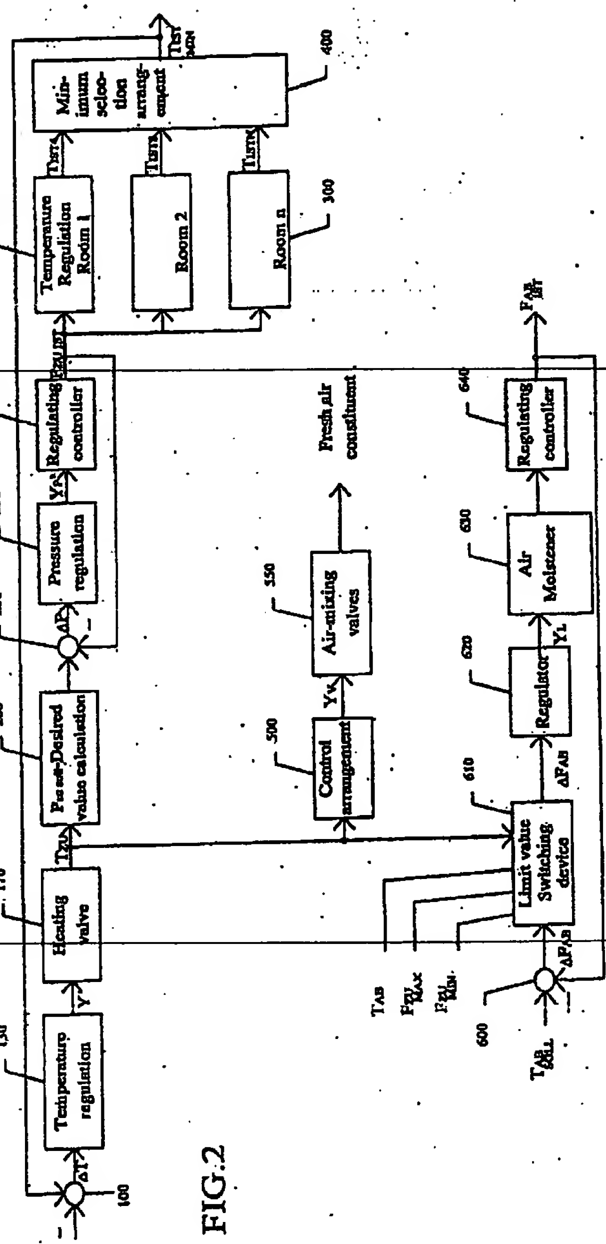

100
ΔT
130
Temperature regulation
Y
170
Heating valve
TZU
200
Preset-Desired value calculation
230
ΔP
250
Pressure regulation
YP
280
Regulating controller
TZU IST
300
Temperature Regulation Room 1
Room 2
Room n
TIST1
TIST2
TISTN
400
Minimum selection arrangement
TIST MIN
500
Control arrangement
YV
550
Air-mixing valves
Fresh air constituent
TAB
FAB MAX
FAB MIN
600
TAB SOLL
ΔFAB
610
Limit value Switching device
620
Regulator
YL
630
Air Moistener
640
Regulating controller
FAB IST

FIG.2

FIG.3

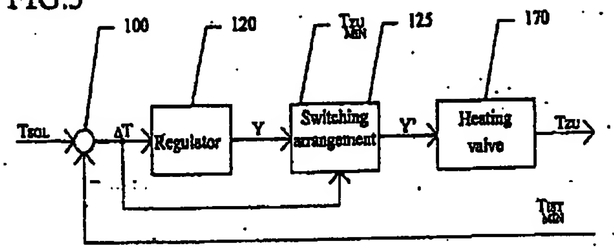


FIG.4

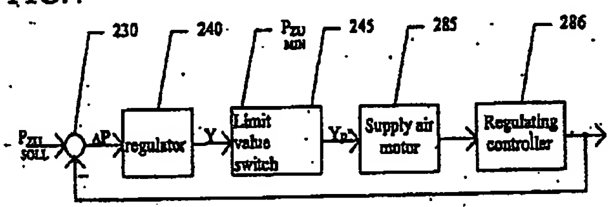


FIG.5

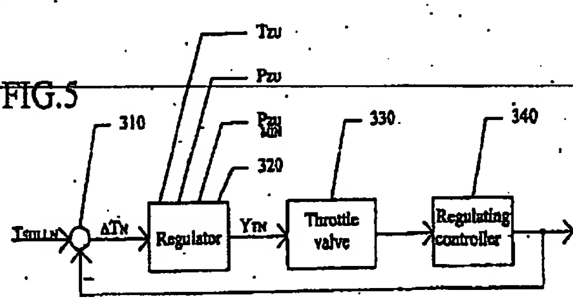


FIG.6a

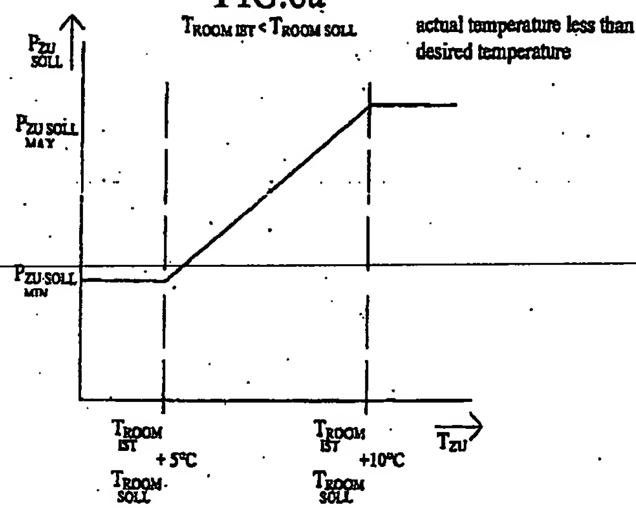

T ROOM IST < T ROOM SOLL
actual temperature less than desired temperature
P ZU SOLL
P ZU SOLL MAX
P ZU SOLL MIN
T ROOM IST + 5°C T ROOM SOLL
T ROOM IST +10°C T ROOM SOLL
T ZU

FIG.6b

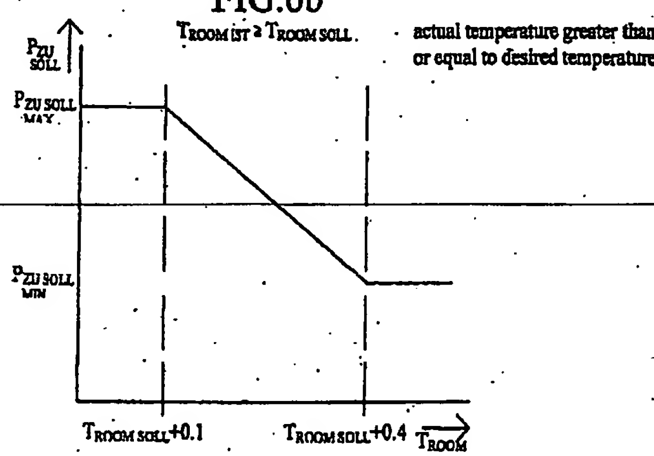
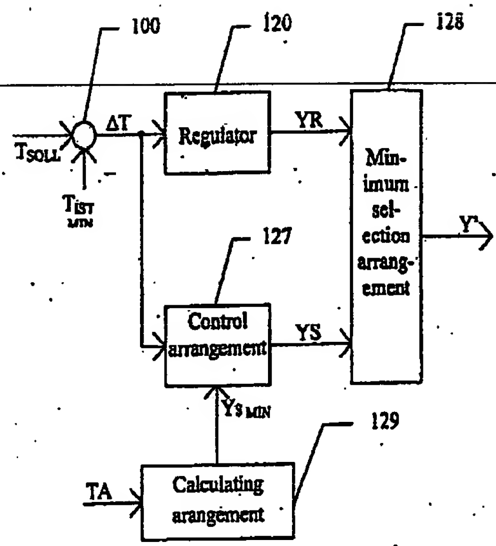

T ROOM IST ≥ T ROOM SOLL
actual temperature greater than or equal to desired temperature
P ZU SOLL
P ZU SOLL MAX
P ZU SOLL MIN
T ROOM SOLL +0.1
T ROOM SOLL +0.4
T ROOM

FIG.7


100
120
128
ΔT
Regulator
YR
TSOLL
TIST MIN
Min-imum sel-ection arrang-ement
Y'
127
Control arrangement
YS
YS MIN
129
TA
Calculating arangement

Best Available Copy

FIG.8a

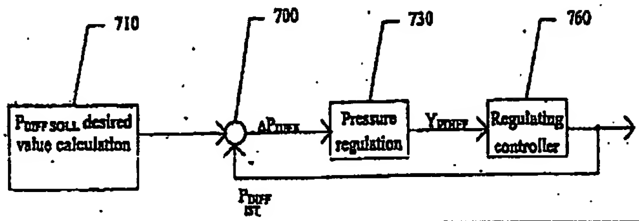


FIG.8b

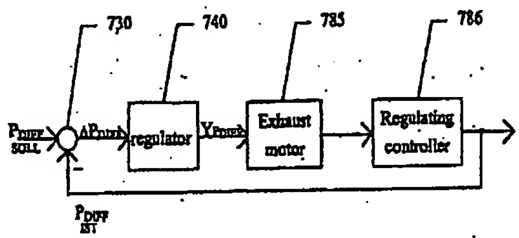


FIG.8c

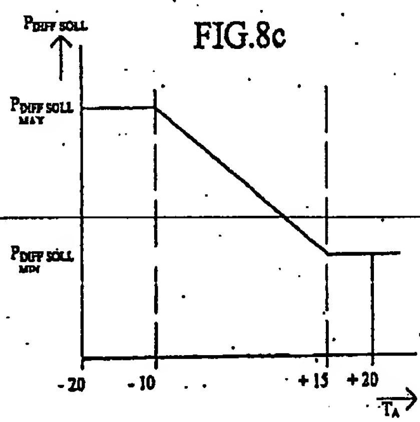


FIG.9

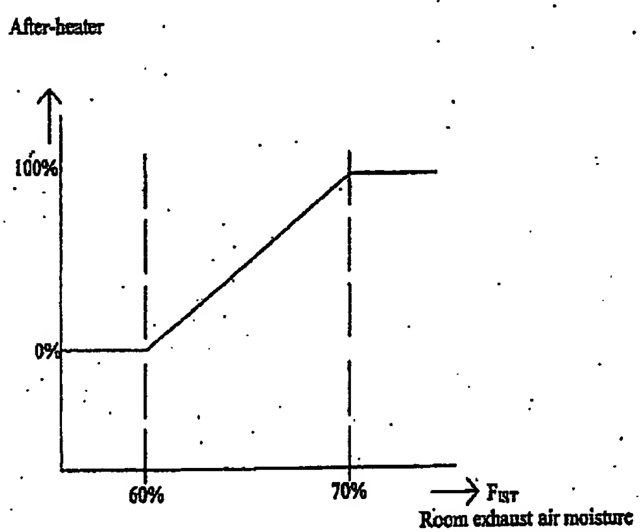
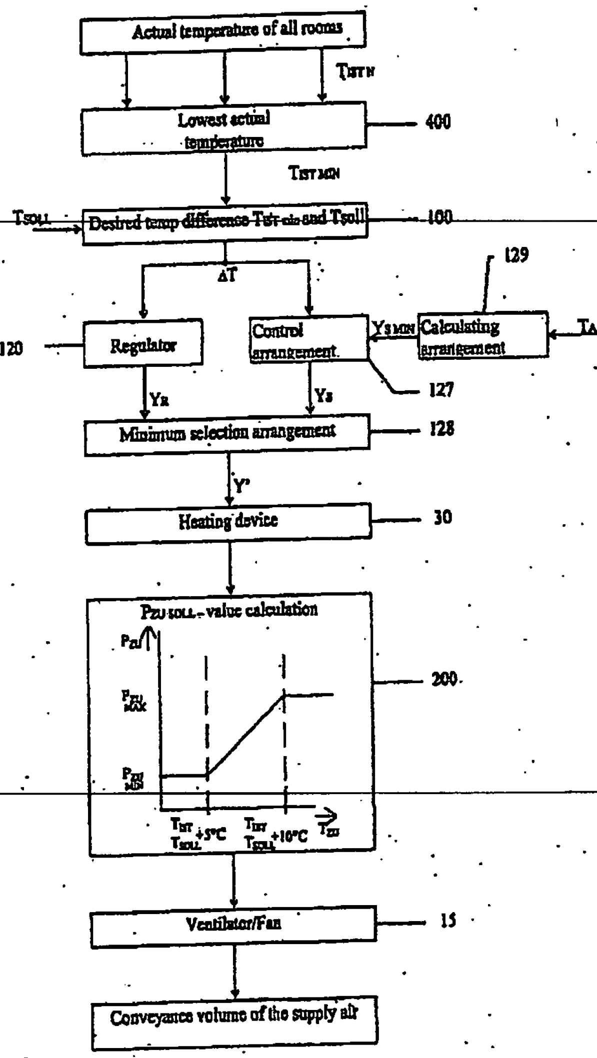


FIG.10


Actual temperature of all rooms
$T_{IST\,N}$
Lowest actual temperature
400
$T_{IST\,MIN}$
T_{SOLL}
Desired temp difference $T_{IST\,min}$ and Tsoll
100
129
ΔT
120
Regulator
Control arrangement
$Y_{S\,MIN}$
Calculating arrangement
T_A
127
Y_R
Y_S
Minimum selection arrangement
128
Y'
Heating device
30
$P_{ZU\,SOLL}$ - value calculation
P_{ZU}
$P_{ZU\,MAX}$
$P_{ZU\,MIN}$
T_{IST} T_{SOLL} +5°C
T_{IST} T_{SOLL} +10°C
T_{ZU}
200
Ventilator/Fan
15
Conveyance volume of the supply air

CERTIFICATE OF FILING AND SERVICE

I hereby certify that on this 26th day of October, 2009, two bound copies of the Brief of Appellant were served via U.S. Mail, postage prepaid, to the following:

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I further certify that on this 26th day of October, 2009, the required number of copies of the Brief of Appellant were hand filed at the Office of the Clerk, United States Court of Appeals for the Federal Circuit.

The necessary filing and service were performed in accordance with the instructions given me by counsel in this case.

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CERTIFICATE OF COMPLIANCE

Pursuant to Federal Circuit Rule 28(a)(14) and Federal Rule of Appellate Procedure 32(a)(7)(C), counsel for Appellant hereby certifies that the foregoing Brief of Appellant complies with the type-volume limitation proscribed in Federal Rule of Appellate Procedure 32(a)(7)(B) and was prepared using the following:

Microsoft Word 2000;

Times New Roman;

14 point typeface.

Appellant's counsel has relied on the word count function of the word-processing program used to prepare this Brief of Appellant, which indicates that this brief contains 8,249 words, excluding the parts exempted by Federal Rule of Appellate Procedure 32(a)(7)(B)(iii) and Federal Circuit Rule 32(b).

Respectfully Submitted,

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Dated: October 26, 2009

Appeal No. 2009-1383
(Application Serial No. 08/998,507)

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

IN RE ALBERT BAUER

Appeal from the United States Patent and Trademark Office,
Board of Patent Appeals and Interferences.

BRIEF FOR APPELLEE - DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

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December 8, 2009

Representative Claim

44. An air-conditioning apparatus for controlling a temperature condition in at least one room to achieve a selected room temperature condition for ventilation using temperature adjusted supply air comprising:

> a supply air motor for supplying air at a supply air pressure through a supply air channel to the at least one room;
> cooling-heating means for adjusting a temperature of the supply air;
> means for regulating an increase in pressure in the at least one room relative to an outside pressure, <u>to vary the room pressure in correspondence to the selected room temperature</u>.

* * * *

A415; 446 (emphasis added).